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01 AERONAUTICS (GENERAL)

N76-24143*+ National Aeronautics and Space Administration, Washington, D.C.
A CUMULATIVE INDEX TO AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY, JANUARY 1976
Jan. 1976 591 p refs
(NASA-SP-7037(66)) Avail: NTIS HC $10.00 CSCL 01A

This publication is a cumulative index to the abstracts contained in NASA SP-7037 (54) through NASA SP-7037 (65) of Aeronautical Engineering: A Special Bibliography. NASA SP-7037 and its supplements have been compiled through the cooperative efforts of the American Institute of Aeronautics and Astronautics (AIAA) and the National Aeronautics and Space Administration (NASA). This cumulative index includes subject, personal author, corporate source, contract, and report number indexes. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N76-24144*# Lockheed-Georgia Co., Marietta.
STUDY OF THE APPLICATION OF ADVANCED TECHNOLOGIES TO LAMINAR FLOW CONTROL SYSTEMS FOR SUBSONIC TRANSPORTS. VOLUME 1: SUMMARY Final Report
R. F. Sturgeon, J. A. Bennett, F. R. Etchberger, R. S. Ferrill, and L. E. Meade May 1976 63 p refs
(Contract NAS1-13694)
(NASA-CR-144975; LG76ER0076-Vol-1) Avail: NTIS HC $4.50 CSCL 01A

A study was conducted to evaluate the technical and economic feasibility of applying laminar flow control to the wings and empennage of long-range subsonic transport aircraft compatible with initial operation in 1985. For a design mission range of 10,186 km (5500 n mi), advanced technology laminar-flow-control (LFC) and turbulent-flow (TF) aircraft were developed for both 200 and 400-passenger payloads, and compared on the basis of production costs, direct operating costs, and fuel efficiency. Parametric analyses were conducted to establish the optimum geometry for LFC and TF aircraft, advanced LFC system concepts and arrangements were evaluated, and configuration variations maximizing the effectiveness of LFC were developed. For the final LFC aircraft, analyses were conducted to define maintenance costs and procedures, manufacturing costs and procedures, and operational considerations peculiar to LFC aircraft. Compared to the corresponding advanced technology TF transports, the 200- and 400-passenger LFC aircraft realized reductions in fuel consumption up to 28.2%, reductions in direct operating costs up to 8.4%, and improvements in fuel efficiency, in ssm/lb of fuel, up to 39.4%. Compared to current commercial transports at the design range, the LFC study aircraft demonstrate improvements in fuel efficiency up to 131%. Research and technology requirements requisite to the development of LFC transport aircraft were identified. Author

N76-24145*# Lockheed-Georgia Co., Marietta.
STUDY OF THE APPLICATION OF ADVANCED TECHNOLOGIES TO LAMINAR-FLOW CONTROL SYSTEMS FOR SUBSONIC TRANSPORTS. VOLUME 2: ANALYSES Final Report
R. F. Sturgeon, J. A. Bennett, F. R. Etchberger, R. S. Ferrill, and L. E. Meade May 1976 471 p refs
(Contract NAS1-13694)
(NASA-CR-144949; LG76ER0076-Vol-2) Avail: NTIS HC $12.00 CSCL 01A

For abstract, see N76-24144.

N76-24146# Advisory Group for Aerospace Research and Development, Paris (France).
UNSTEADY AERODYNAMICS
Mar. 1976 91 p refs Presented at the Fluid Dyn. Panel Round Table Discussion on Unsteady Aerodyn., Goettingen, West Germany, May 1975
(AGARD-R-645) Avail: NTIS HC $5.00

Five papers are presented covering such topics as calculation methods in unsteady aerodynamics, recent research results in flutter suppression, transonic flow, unsteady rotor blade aerodynamics, wind tunnel test techniques, and recent research efforts in aeroelasticity and unsteady aerodynamics at the U.S. Air Force Flight Dynamics Laboratory. These papers gave a succinct review of the present state of aeroelasticity-oriented unsteady aerodynamics. For individual titles, see N76-24147 through N76-24151.

N76-24147 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
UNSTEADY AERODYNAMIC PREDICTION METHODS APPLIED IN AEROELASTICITY
B. Laschka *In* AGARD Unsteady Aerodyn. Mar. 1976 31 p refs (For availability see N76-24146 15-02)

A brief survey is given on the basic prediction methods in unsteady aerodynamics needed in aeroelasticity. After an introductory outline of some of the most important aeroelastic phenomena, some representative concepts applied to calculate unsteady aerodynamic forces in subsonic and supersonic flow are described. Then, attention is drawn to areas which are not yet covered adequately by the presently existing theories. These aeas comprise effects of gap geometry between fixed wing and control surfaces, of mean incidence about which a wing or control surface is oscillating, of wing thickness, of Reynolds number, etc. Furthermore, some not yet published results related to interfering multiple lifting configurations are presented. These results include thrust calculations on oscillating tandem wings in incompressible flow, wing induced unsteady tail loads and

some downwash evaluations behind wings in supersonic flow. Author

N76-24148 National Aerospace Lab., Amsterdam (Netherlands).
SOME REMARKS ON UNSTEADY TRANSONIC FLOW
H. Tijdeman *In* AGARD Unsteady Aerodyn. Mar. 1976 11 p refs (For availability see N76-24146 15-02)

A general discussion of unsteady transonic aerodynamics is presented. A simple example of an airfoil having an oscillating trailing edge flap was chosen for the discussion. Results are presented from wind tunnel tests performed on the airfoil to illustrate the interactions of steady flow fields on unsteady flow fields. Topics discussed include: (1) various calculation methods used to compute unsteady transonic flow (finite difference theory), and (2) boundary layer interactions, and shock wave interactions causing aerodynamic loading. It is shown at high subsonic and transonic speeds that unsteady airloads are influenced considerably by steady and unsteady flow fields and shock wave interactions. J.R.T.

N76-24149 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTEADY AERODYNAMICS OF HELICOPTER BLADES
Rolland Dat *In* AGARD Unsteady Aerodyn. Mar. 1976 6 p refs In FRENCH; ENGLISH summary (For availability see N76-24146 15-02)

A method that predicts the unsteady periodic aerodynamic forces on helicopter blades in forward flight is described. The blade sections are assimilated to airfoils; the lift at high angle attack is given by a mathematical model and the three-dimensional interferences between blades and between separate sections of the same blades are given by the linearized lifting surface theory. The comparison between theoretical and experimental results is satisfactory. The range of applications of the method used to synthetize the three-dimensional theory and the experiments in two-dimensional flow is not restricted to helicopters. Author

N76-24150 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
WIND TUNNEL TEST TECHNIQUES FOR THE MEASUREMENT OF UNSTEADY AIRLOADS ON OSCILLATING LIFTING SYSTEMS AND FULL-SPAN MODELS
H. Foersching *In* AGARD Unsteady Aerodyn. Mar. 1976 24 p refs (For availability see N76-24146 15-02)

The main features of wind tunnel test techniques in current use for the measurement of dynamic stability derivatives, flutter coefficients and unsteady aerodynamic pressure distributions are described. The presentations are illuminated by some typical test results. Author

N76-24151 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Vehicle Dynamics Div.
BRIEF OVERVIEW OF SOME AIR FORCE FLIGHT DYNAMICS LABORATORY RESEARCH EFFORTS IN AEROELASTICITY AND AERO-ACOUSTICS
Walter J. Mykytow *In* AGARD Unsteady Aerodyn. Mar. 1976 13 p refs (For availability see N76-24146 15-02)

The feasibility of extending active feedback control technology to flutter suppression in wings and external stores is discussed. Flight tests of a B-52 full scale model are described. A computer program for flutter optimization is discussed. The use of composite materials in flutter suppression is examined. J.R.T.

N76-24152*# Grumman Aerospace Corp., Bethpage, N.Y.
DEVELOPMENT OF A COMPUTER CODE FOR CALCULATING THE STEADY SUPER/HYPERSONIC INVISCID FLOW AROUND REAL CONFIGURATIONS. VOLUME 2: CODE DESCRIPTION Final Report
Frank Marconi and Larry Yaeger Washington NASA May 1976 153 p ref
(Contract NAS1-11525)
(NASA-CR-2676) Avail: NTIS HC $6.75 CSCL 01A

A numerical procedure was developed to compute the inviscid super/hypersonic flow field about complex vehicle geometries accurately and efficiently. A second-order accurate finite difference scheme is used to integrate the three-dimensional Euler equations in regions of continuous flow, while all shock waves are computed as discontinuities via the Rankine-Hugoniot jump conditions. Conformal mappings are used to develop a computational grid. The effects of blunt nose entropy layers are computed in detail. Real gas effects for equilibrium air are included using curve fits of Mollier charts. Typical calculated results for shuttle orbiter, hypersonic transport, and supersonic aircraft configurations are included to demonstrate the usefulness of this tool. Author

N76-24153*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCE OF 0.4066-SCALE MODEL TO JT8D REFAN STAGE
Royce D. Moore, George Kovich, and Edward R. Tysl Washington Mar. 1976 157 p refs
(NASA-TM-X-3356; E-8040) Avail: NTIS HC $6.75 CSCL 01A

The aerodynamic performance of a scale model of the split flow JT8D rafan stage is presented over a range of flows at speeds from 40 to 100 percent design. The bypass stage peak efficiency of 0.800 occurred at a total weight flow of 35.82 kilograms per second and a pressure ratio of 1.697. The stall margin was 15 percent based on pressure ratio and weight flow at stall and peak efficiency conditions. The data indicated that the hub region of the core stators was choked at design speed over the entire flow range tested. Author

N76-24154# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
CALCULATION OF AERODYNAMIC DERIVATIVES IN UNSTEADY TWO-DIMENSIONAL TRANSONIC FLOW USING DOWELL'S LINEARIZATION METHOD
Paul H. Park Sep. 1975 77 p refs Backup document for AIAA Synoptic, "Unsteady Two-Dimensional Transonic Flow Using Dowell's Method", scheduled for publication in AIAA Journal in Oct. 1976
(AMS-1238-T) Avail: NTIS HC $5.00

The Dowell's linearization method was applied to the calculation of pressure derivatives with lift and moment derivatives in unsteady two-dimensional sonic flow for a parabolic arc airfoil in heave and pitch. The equations for the unsteady derivatives are developed following the manner of the steady derivatives as done by Dowell. A computer program was written to carry out the integrations contained in the equations. Solutions are presented for various reduced frequencies and, where possible, are compared with other theories and experimental data. Author

N76-24155# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
BOUNDARY LAYER EFFECTS
K.-H. Gronau, ed. and H.-U. Meier, ed. Bonn DOKZENTBw 1975 186 p refs Proc. of the 4th US-FRG Meeting, Goettingen, West Ger., 2-3 Jun. 1975 Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-75-21) Avail: NTIS HC 7.50; DOKZENTBw DM 50

The theoretical work is mainly concerned with computer solutions of the Navier Stokes equations, higher order boundary layers, unsteady boundary layers, new turbulence models, and engineering calculation methods of three dimensional boundary layers. The experimental research includes investigations of boundary layers at very high Reynolds numbers, the Magnus effect at supersonic flow, shock-wave boundary layer interactions, and turbulent flow connected with reattachment and separation, as well as the influence of the turbulence level of the free stream on the boundary layer development. For individual titles, see N76-24156 through N76-24167.

N76-24156 Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
SUPERSONIC LAMINAR BOUNDARY-LAYER FLOW OVER MULTIPLE SINUSOIDAL PROTUBERANCES
A. Polak, M. J. Werle, V. N. Vatsa, and S. D. Bertke *In* DFVLR Boundary Layer Effects 1975 p 9-19 refs (For availability see N76-24155 15-02)

An Alternating Direction Implicit (ADI) numerical algorithm was used to resolve the distortion of an approaching Blasius type supersonic laminar boundary layer flowing over a train of

sine wave protuberances placed on a flat plate. The main features of the algorithm are: solving of the exact interacting boundary layer equations, calculating the pressure gradient from the slope of the displacement body, and directly incorporating the downstream boundary condition in the solution with the effect that the strong upstream influence is manifested in the solutions. ESA

N76-24157 Naval Ship Research and Development Center, Bethesda, Md.
COMPUTER SOLUTIONS OF THE NAVIER-STOKES EQUATIONS OF VISCOUS FLUID MOTION
Joanna W. Schot *In* DFVLR Boundary Layer Effects 1975 p 20-24 refs (For availability see N76-24155 15-02)

Examples are given of computer calculation of the flow development inherent in the Navier-Stokes equations, including the variation in drag, lift, and moment coefficients as a function of time for laminar incompressible viscous flow past elliptic cylinders of infinite span. One computer program was used to analyze flow behavior past an abruptly accelerated elliptic cylinder at 45 deg incidence. Numerical solutions of the energy equation have recently been investigated to augment this study. Steady-state solutions were obtained for Re = 15 and Re = 30, whereas for Re = 200 a Karman vortex street develops. This phenomenon cannot be calculated from the boundary layer theory. Computer generated pictures of the streamlines, the lines of constant vorticity, and the lines of constant temperature obtained for the case of Re = 200, Pr = 0.7 and E = 1 are presented. ESA

N76-24158 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
HIGH REYNOLDS NUMBER TURBULENT BOUNDARY LAYER MEASUREMENTS
Anthony W. Fiore *In* DFVLR Boundary Layer Effects 1975 p 25-40 refs (For availability see N76-24155 15-02)

Turbulent boundary layer profiles and skin friction were measured at extremely high Reynolds numbers. Tests were conducted at a Mach number of three for near adiabatic wall conditions in the Reynolds number range of 10 to the 7th power to 10 to the 9th power. The measurements were made on the wall of a tunnel. The Reynolds number was varied by changing both the stagnation pressure and the probing station. ESA

N76-24159 Ballistic Research Labs., Aberdeen Proving Ground, Md.
THREE-DIMENSIONAL BOUNDARY LAYER RESEARCH AS APPLIED TO THE MAGNUS EFFECT ON SPINNING PROJECTILES
Walter B. Sturek *In* DFVLR Boundary Layer Effects 1975 p 41-63 refs (For availability see N76-24155 15-02)

Experimental and theoretical research studies of the boundary layer on yawed, spinning bodies of revolution in supersonic flow are reported. Computed results of the Magnus effect are shown for circumferential velocity profiles and boundary layer displacement thickness for the laminar boundary layer on a yawed, spinning cone. A comparison between computed values and experimental strain gage balance measurements of Magnus force is shown to yield encouraging agreement. Surveys of the boundary layer on a yawed, spinning tangent-ogive-cylinder model were made at azimuthal stations completely about the circumference of the model. Measurements were also made of wall static pressure on a yawed body of revolution. Examples of these data are discussed. Author (ESA)

N76-24160 Ruhr Univ., Bochum (West Germany).
RECENT RESULTS AND SUMMARY OF HIGHER ORDER BOUNDARY-LAYER RESEARCH
K. Gersten, J. F. Gross (Arizona Univ., Tucson), and V. VasantaRam *In* DFVLR Boundary Layer Effects 1975 p 66-81 refs (For availability see N76-24155 15-02)

Results are presented of higher order boundary layer research, in which Prandtl's boundary layer theory is extended towards lower Reynolds numbers. This theory also permits a systematic study of the effects neglected in classical boundary layer theory. Higher-order effects were studied for stagnation point flows and for cylindrical surfaces in supersonic flow. ESA

N76-24161 Technische Univ., Berlin (West Germany).
LAMINAR THREE-DIMENSIONAL FLOWS PAST BODIES OF ARBITRARY SHAPE
E. Elsholz and W. Haase *In* DFVLR Boundary Layer Effects 1975 p 82-90 refs (For availability see N76-24155 15-02)

The flow of a uniform stream past various types of bodies was investigated. The fluid was assumed to be homogeneous and incompressible, and the flow problem governed by the Navier-Stokes equations. The phenomena were studied using difference approximations to the steady state Navier-Stokes equations. The difference equations were solved numerically using a CDC 6500 computer. To check the stability and accuracy of the computer program, flows were calculated past a sphere at Re = 40 and Re = 200, based on the sphere diameter. ESA

N76-24162 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
UNSTEADY BOUNDARY LAYER RESEARCH AT VKI
H. J. Wirz *In* DFVLR Boundary Layer Effects 1975 p 91-95 refs (For availability see N76-24155 15-02)

Finite difference methods have been developed to treat unsteady incompressible and compressible boundary layers including heat transfer. Results are available for the impulsive start of incompressible flow around arbitrary bodies. A finite difference method was developed for turbulent unsteady boundary layers employing a simple eddy viscosity concept to deal with unsteady flow over flat plates. ESA

N76-24163 Ruhr Univ., Bochum (West Germany).
TURBULENT FLOW CONNECTED WITH SEPARATION AND REATTACHMENT
V. VasantaRam and P. Wauschkuhn *In* DFVLR Boundary Layer Effects 1975 p 96-103 refs (For availability see N76-24155 15-02)

The flow past a rearward facing step is taken as a typical example of a flow involving separation. The features of this flow are discussed: the displacement problem, in particular the pressure distribution effectively induced by the separated region; the reattachment problem, which is closely related to the question of whether a bubble or a fully separated region with adjoining wake is formed; and the problem of the relaxing boundary layer (or wake) downstream of reattachment. ESA

N76-24164 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.
THE INFLUENCE OF LOW FREE STREAM TURBULENCE ON THE DEVELOPMENT OF THE TURBULENT BOUNDARY LAYER AT ZERO PRESSURE GRADIENT. PRELIMINARY RESULTS
H. U. Meier *In its* Boundary Layer Effects 1975 p 104-118 refs (For availability see N76-24155 15-02)

Experiments for air flow over a flat sidewall of a low turbulence wind tunnel are described. Boundary layer measurements were carried out at a fixed distance from the nozzle exit in the freestream velocity range of 10 m/s to 40 m/s. For these test conditions the response of the turbulent boundary layer to the turbulence level Tu in the external free stream was studied. In order to increase the low turbulence level of the tunnel from Tu about 0.2 % to Tu about 1.3 %, a grid with square meshes was installed at the nozzle exit. Author (ESA)

N76-24165 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
SIMILAR SOLUTIONS FOR TURBULENT SHEAR FLOWS DESCRIBED BY MEAN VELOCITY, TURBULENT ENERGY, AND TURBULENT LENGTH SCALE
H. Vollmers and J. C. Rotta *In its* Boundary Layer Effects 1975 p 119-143 refs (For availability see N76-24155 15-02)

Progress in describing the turbulent motion of a fluid by a set of differential equations proposed by Rotta is reported. The influence of the constant coefficients introduced for the closure of the system was investigated. Their values were adjusted for six different flow fields by comparison with experimental data. An optimized set of values for the coefficients was obtained. Author (ESA)

N76-24166 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

A FINITE DIFFERENCE METHOD FOR THE CALCULATION OF THREE-DIMENSIONAL BOUNDARY LAYERS ON SWEPT WINGS

Gert R. Schneider *In its* Boundary Layer Effects 1975 p 144-168 refs (For availability see N76-24155 15-02)

A numerical method to calculate the three-dimensional incompressible turbulent boundary layer on swept wings for different angles of yaw and different pressure distributions is presented. The governing turbulent boundary layer equations are integrated using an implicit finite difference procedure with variable step sizes in conjunction with the mixing length hypothesis for the distribution of the turbulent shear stress. For the mixing length the formulas of Michel et al. are used with a correction function for which the local value of shear stress is used instead of the wall value, as originally recommended by Van Driest for his damping factor. The two nonlinear turbulent momentum equations are linearized each in one direction. The following linear equations are solved one after another in an iterative procedure for which the starting values are extrapolated from the last two stations. The number of iterations is controlled by the velocity values normal to the wall. As starting profile for the whole numerical procedure a two-dimensional turbulent boundary layer profile with zero pressure gradient is used.

Author (ESA)

N76-24167 Dornier-System G.m.b.H., Friedrichshafen (West Germany).

AN INTEGRAL PREDICTION METHOD FOR THREE-DIMENSIONAL TURBULENT COMPRESSIBLE BOUNDARY LAYERS

H. W. Stock and W. Schmidt *In* DFVLR Boundary Layer Effects 1975 p 169-175 refs (For availability see N76-24155 15-02)

An integral method is presented which allows the computation of three-dimensional compressible turbulent boundary layers along curvilinear nonorthogonal coordinates. The abandonment of the streamline coordinate system yields two advantages: the coordinate system can remain unchanged despite changes in the external flow and the axis system may be chosen to give an even coverage of the body surface. The evaluation of the metric tensor of the surfaces is done by using bicubic spline interpolation. ESA

N76-24168# Sandia Labs., Albuquerque, N.Mex.

PARACHUTE CLUSTER DYNAMIC ANALYSIS

D. F. Wolf and H. R. Spahr 1975 9 p refs Presented at the AIAA Aerodyn. Deceleration Sys. Conf., Albuquerque Sponsored by ERDA

(SAND-75-5502; Conf-751127-1) Avail: NTIS HC $4.50

A computer aided dynamic analysis of a parachute cluster is described which models the individual parachutes in the cluster and their combined effects on the motion of the attached forebody. The complex three dimensional motions of the forebody/parachute system are displayed using computer generated drawings of the bodies. Actual motion studies are accomplished using computer generated color movies. Simulated motion drawings and drop test photographs are presented for a system consisting of a cluster of three small parachutes attached to a large forebody and for a cluster of three large parachutes attached to a small forebody which experiences a rapid pitch motion. The necessity of modeling each parachute individually is illustrated for both systems. Author (ERA)

N76-24169# Technische Hochschule, Aachen (West Germany). Stosswellenlab.

EXPERIMENTAL INVESTIGATIONS ON REENTRY BODIES AT HYPERSONIC SPEEDS. PART 1: HEAT FLUX AND PRESSURE DISTRIBUTION OF SIMPLE REENTRY MODELS Final Report [EXPERIMENTELLE UNTERSUCHUNGEN AN RAUMFLUGKOERPERN IM HYPERSCHALLBEREICH. TEIL 1: WAERMEFLUSS- UND DRUCKVERTEILUNG AN EINFACHEN WIEDEREINTRITTSMODELLEN]

Hans Groenig and Heinz Schumacher Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.

(BMFT-FB-W-75-21-Pt-1) Avail: NTIS HC $4.00; ZLDI, Munich DM 8.20

Various reentry models were experimentally tested in a shock tunnel. These models consisted of a slab delta wing, a blunt elliptical half-cone, and an integrated configuration. Aerodynamic control systems were tested by means of simple models: a delta wing with an attached rudder and the integrated model with a flap at two different angles. The flow Mach number was 6.6, and the angle of attack varied between 0 and 60. The comparison between the experimental and theoretical results show partly reasonable agreement and also a considerable influence of cross-flow, especially at high angles of attack. Author (ESA)

N76-24170# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.

CALCULATION METHOD FOR SEPARATED FLOW OF SLENDER ARROW WINGS [EIN BERECHNUNGSVERFAHREN ZUR ABGELOESTEN STROEMUNG AM SCHLANKEN PFEILFLUEGEL]

Klaus Huenecke 1975 68 p refs In GERMAN

(ILR-5-1975; ISBN-3-7983-0541-2) Avail: NTIS HC $4.50

A method for calculating the flow around a lifting wing of small to moderate span, which accounts for leading edge separation was developed. The isolated vortex flow is described by the Navier-Stokes equations in quasicylindrical approximation, whereas the vortices on the lifting wing are calculated using a two-dimensional panel method. Experimental knowledge of vortex distribution on similar wings was used for the calculation. Good agreement is obtained between calculated and observed vortex distribution. ESA

N76-24171# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

DETERMINATION OF DERIVATIVES FROM FLIGHT TESTS [ERMITTLUNG VON DERIVATIVA AUS FLUGVERSUCHEN]

H. Friedrich, L. Borucki, H. Brill, F.-J. Hoelscher, W. Simm, and R. Tauchmann Bonn DOKZENTBw 1975 91 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-75-8) Avail: NTIS HC $5.00; DOKZENTBw DM 30

A flight test analysis using the time vector method was further developed. A Kalman filter was developed and programmed to improve the measured data. The airborne data acquisition system was checked and improved, and the time behavior of the sensors was determined. The preanalysis of the flight tests by the manual evaluation technique was improved, and flights prepared and supervised. In the case of the time vector method the limits were reached. The expectations could not be fully verified. A complete filter program was developed for the Kalman filter. Author (ESA)

N76-24172# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

THE SIMULATION AND PREDICTION OF GROUND EFFECT IN CAR AERODYNAMICS

J. E. Fackrell Nov. 1975 36 p refs Sponsored by a Donald Cambell Res. Fellowship

(IC-Aero-75-11) Avail: NTIS HC $4.00

The effect of the ground on an idealized, car-like, body, with and without spoilers, was examined in a wind tunnel using both moving and stationary ground simulation. Force and surface pressure measurements were obtained over a range of ground clearance and incidence. The lift was found to increase at positive incidence and decrease at negative incidence as the ground is approached, thereby producing an increase in lift curve slope. The moving floor produced a greater increase in lift curve slope and a general decrease in lift compared to the stationary floor, having most effect in negatively lifting cases and, in particular, when the body was fitted with a spoiler under the nose. The drag force was little affected by the presence of the ground or by the mode of simulation employed. Changes in the overall forces were produced almost entirely by changes in the pressures on the undersurface and nose of the body; pressures on the top surface being unaltered. A two-dimensional, free streamline method was employed on shapes whose cross sections were the same as those of the three-dimensional experimental bodies

and was found to give a surprisingly good prediction of the qualitative trends observed in the experiments. Author (ESA)

N76-24173# Royal Aircraft Establishment, Farnborough (England).
WIND TUNNEL MEASUREMENTS AT M=1.6 OF THE AERODYNAMIC EFFECTS OF A ROOT GAP ON A CONTROL SURFACE OF SQUARE PLANFORM MOUNTED ON A BODY
K. G. Winter May 1975 34 p refs
(RAE-TM-AERO-1641; BR48386) Avail: NTIS HC $4.00

Increasing the root gap from 0.4 to 9.9 % span reduces the normal force for small angles of incidence of the body and zero control surface deflection by between 5 and 10 % but has little effect for zero angle of incidence and small control deflection. The center of pressure moves forward by about 0.5 % chord and outboard by about 5 % span with increase of the gap for small angles of either the body or the control surface, though the spanwise change for zero control deflection differs for the two lengths of body tested. Author (ESA)

N76-24174# Laboratoire d'Aerothermique du C.N.R.S., Meudon (France).
FREE JETS AND JETS EMITTED AT THE BASE OF A CYLINDER WITHIN HYPERSONIC FLOW [ETUDE DE JETS LIBRES ET DE JETS EMIS AU CULOT D'UN CYLINDRE PLACE DANS UN ECOULEMENT HYPERSONIQUE]
Christian Bisch Apr. 1975 35 p refs In FRENCH; ENGLISH summary
(Rept-75-2; Publ-497) Avail: NTIS HC $4.00

Pressure and concentration measurements concerning underexpanded free jets and base jets with a hypersonic outside flow are given and compared. The results which agree with a theoretical model indicate the importance of the increased mass flow rate along the boundary of the jet as compared with the mass flow rate along the axis. Author (ESA)

N76-24175# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
FURTHER DEVELOPMENT OF THE PANEL METHOD. PART 1: NONLINEAR PANEL METHOD CONSIDERING DISCRETE SEPARATED VORTEX SHEETS ON SWEPT SLENDER WING SHAPES
W. Sonnleitner and W. Kraus 21 Dec. 1973 148 p refs In GERMAN; ENGLISH summary
(Contract T-0250-12510-11059)
(MBB-UFE-1070-O) Avail: NTIS HC $6.00

A comprehensive literature search was conducted in order to find those publications, which are best suited for the calculation of wings with a small aspect ratio and a complex planform. The complex planform results from the application of strakes, sawteeth, flaps, and slats on the aircraft. A nonlinear panel method was developed which doesn't know any limitation as far as planform, wing-shaping, and fuselage considerations are concerned. Vortex models according to Bollay, Gersten, and Belotserkovsky were tested. Author (ESA)

N76-24176# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
APPLICATION OF THE MBB PANEL METHOD TO CALCULATION OF WING-BODY CONFIGURATIONS WITH EXTERNAL STORE LOADS [ANWENDUNG DES MBB-PANEL-VERFAHRENS ZUR BERECHNUNG VON FLUEGEL-RUMPF-KONFIGURATIONEN MIT AUSSENLASTEN]
R. Deslandes and A. Eberle 6 Mar. 1974 98 p refs In GERMAN
(MBB-UFE-1073-O) Avail: NTIS HC $5.00

The method was used to calculate the aerodynamic characteristics of body-wing configurations with external store. It is shown that the method produces results comparable to measurements for pressure distributions, sectional loads, jointing plane coefficients, and total aerodynamic coefficients. Special problems such as suspension of the external store and circulative components of the store are discussed. ESA

N76-24177# Bristol Univ. (England). Dept. of Civil Engineering.
ON THE VORTEX-INDUCED LOADING ON LONG BLUFF CYLINDERS Ph.D. Thesis
Roger Hollins Wilkinson Mar. 1974 233 p refs
Avail: NTIS HC $8.00

A rigid bluff cylindrical body in a flow with its axis perpendicular to the approach direction will experience periodic forces superimposed on the steady lift and drag. These forces are associated with vortices shed from the body with their axes approximately parallel to that of the cylinder. However, the vortices are not truly parallel with the shedding cylinder, the shedding process being of varying phase along the span. An experimental study is made of the three-dimensionality of the shedding process, and its effect upon the total dynamic loading on the cylinder. It has been shown by previous workers that, if the shedding cylinder undergoes cross flow oscillation at a frequency similar to that of the vortex shedding from the stationary cylinder, the vortex shedding process is modified. The interaction between the flow field and structural movement is studied by measurement of the mean and dynamic pressure distributions on a long square cylinder whilst stationary and during forced vibration. The dynamic pressure field is studied by measurement of the root mean square of the surface pressure distributions, together with measurement of the normalized cross-correlation field to enable the total dynamic loads on the cylinder to be ascertained. Author (ESA)

N76-24178# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Aerodynamik.
FLOW INVESTIGATION ON WINGS WITH KINKED LEADING EDGES AND SWEPT OUTER WINGS AT MODERATE SUBSONIC SPEED
W. Schroeder Jun. 1974 60 p refs In GERMAN; ENGLISH summary
(DLR-IB-151-74/11) Avail: NTIS HC $4.50

Wind tunnel measurements at Reynolds numbers of Re = 0.4 x 1 million and 1 million were performed on two wings which consist of a highly swept (65 deg inner portion - strake), and a moderately swept (30 deg), or highly swept (65 deg) outer portion. The experiments comprised of three component force measurements, oil flow visualization of surface streamlines, flow visualization by means of smoke and total pressure measurements in the flow field. Additionally, the flow around the wings was observed with dye in a water tunnel at Reynolds numbers Re = 2,000 and 10,000. The investigations revealed that for small angles of incidence the wings exhibit linear characteristics corresponding to their aspect ratios. At higher angles of incidence the aerodynamic behavior is governed by well defined flow separation on the inner and outer wing portions. The wing with moderately swept outer portion behaves as a double-delta wing with two pairs of concentrated vortices over its inner and outer portions. In the case of the wing with highly swept outer portion, the concentrated vortices originating from the strakes maintain their straight direction along the outer wing portion. The behavior of this wing is similar to that of a plain delta wing. Author (ESA)

N76-24179# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Aerodynamik.
WING PROFILE DESIGN FOR NEAR-SONIC FLOW USING THE INTEGRAL METHOD [ENTWURF VON TRAGFLUEGELPROFILEN FUER SCHALLNAHE ANSTROEMUNG NACH DER INTEGRALMETHODE]
H. Hansen Mar. 1975 131 p refs In GERMAN
(DLR-IB-151-75/4) Avail: NTIS HC $6.00

A method for wing profile design, based on a given contour velocity distribution with lift, is described for sub- and supercritical flow. The integral method developed by K. Oswatitsch for calculation of the pressure distribution on the contour of a given profile is used to derive a design method. A simplified gas dynamic equation is used, valid for small perturbations in near-sonic flow as well as for stagnation flow. Two integral equations are derived from this for the velocity components on the profile contour, with which the design problem is solved for shock-free flows and Mach numbers less than one. A FORTRAN 4 program was developed and tested for this method. ESA

N76-24180# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Theoretische Aerodynamik.

AIRFOIL DESIGN FOR A PRESCRIBED VELOCITY DISTRIBUTION IN TRANSONIC FLOW BY AN INTEGRAL METHOD

H. Hansen Aug. 1975 27 p refs Presented at the Symp. Transsonicum II, Goettingen, West Ger., 8-13 Sep. 1975
(DLR-IB-151-75/8) Avail: NTIS HC $4.00

A method is presented to calculate an airfoil contour for a prescribed subsonic free stream Mach number and a contour pressure distribution, based on the K. Oswatitsch integral method. A reduced potential equation was derived for small perturbations in transonic flow which is also valid for flows in stagnation regions without restrictions concerning the magnitude of perturbations. An integral method is developed for the solution. This means, that an integration has to be carried out for the design problem, which is performed partly analytically and partly numerically. The integral relation reduces the design problem in nonlinear compressible flow to a corresponding one in linear incompressible flow which is solved by well-proven methods. The method is applied to calculate airfoil contours for prescribed subcritical pressure distributions without and with lift as well as for nonlifting pressure distributions without and with weak shocks. The results show acceptable agreement with those of inverse methods and exact solutions. Author (ESA)

N76-24181# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Entwurfsaerodynamik.

CALCULATION OF BUFFET ONSET FOR SUPERCRITICAL AIRFOILS

G. Redeker Aug. 1975 20 p refs Presented at the IUTAM Symp. Transsonicum II, Goettingen, West Ger., 8-13 Sep. 1975
(DLR-IB-151-75/12) Avail: NTIS HC $3.50

The method of Thomas for calculating buffet onset was improved in such a way that supercritical airfoils as well as high angles of attack and high lift coefficients can be treated. Calculated examples of buffet-onset boundaries for supercritical airfoils show a benefit in lift coefficient and Mach number compared with those of conventional airfoils. Measured buffet onset for the Korn airfoil No. 1 is well predicted by the calculation method. Author (ESA)

N76-24182# European Space Agency, Paris (France).

THEORETICAL ANALYSIS AND PREDICTION METHODS FOR A THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER

Jean Cousteix Jan. 1976 189 p refs Transl. into ENGLISH of 'Anal. Theorique et Moyens de Prevision de la Couche Limite Turbulente Tridimensionelle', ONERA, Paris Report ONERA-P-157, 1974
(ESA-TT-238; ONERA-P-157) Avail: NTIS HC $7.50

A theoretical analysis of the behavior of a three-dimensional turbulent boundary layer is established by means of similarity solutions, using an improved mixing-length model. Various comparisons show that these solutions provide a family of velocity profiles, particularly for the transverse flow velocity, which correcly represent the physical behavior. The hypotheses which form the essential basis for an integral method of calculation can be defined. Such a method is derived for the general case of an arbitrary coordinate-system and for a compressible flow on an adiabatic wall, up to Mach numbers of about 4.0. This method is applied to some experimental cases. the results produced are compared with those from a method which solves the local equations, applied to the special case of infinite swept wings. Author (ESA)

N76-24183# European Space Agency, Paris (France).

A TECHNIQUE AND AN ARRANGEMENT FOR THE CONTROLLED BREAKUP OF JETS OF LIQUID FOR INVESTIGATIONS IN TWO-PHASE FLOWS

Guenther Requardt et al Feb. 1976 57 p refs Transl. into ENGLISH of 'Verfahren u. Anordnung fuer den gesteuerten Zerfall von Fluessigkeitsstrahlen fuer Untersuch. in Zweiphasenstroemungen, DFVLR, Cologne Report DLR-FB-75-55, 12 Aug. 1975 Original German report available from DFVLR, Cologne DM 22.30
(ESA-TT-265; DLR-FB-75-55) Avail: NTIS HC $4.50

A technique to generate equal-sized and equal-spaced droplets is described for aerodynamic investigations. This technique was applied to produce droplet diameters from 0.2 to 2.0 mm of different liquids. It is based on the disturbance of a smooth liquid jet by mechanically transferred sinusoidal oscillations in the frequency range from 200 to 30,000 Hz. The possibility of enlarging the physically given droplet distance by periodically taking out a selectable number of droplets from the free falling droplet chain is also described. This is done by charging and deflecting them, each in a suitable electrostatic field. The experimental arrangement and the tested solutions are discussed in detail and their operation is demonstrated from electrical mesurements. Author (ESA)

N76-24184# European Space Agency, Paris (France).

INVESTIGATION OF THE MUTUAL INTERFERENCE OF WING/ENGINE COMBINATIONS

Manfred Wittmann et al Dec. 1975 173 p refs Transl. into ENGLISH of 'Untersuch. der gegenseitigen Beeinflussung von Fluegel-Triebwerk-Kombinationen', Tech. Hochschule, Aachen Report DLR-FB-74-32, 22 Apr. 1974 Original German report available from DFVLR, Porz. West Ger. DM 60.20
(ESA-TT-217; DLR-FB-74-32) Avail: NTIS HC $6.75

The mutual interference between wing and engine nacelle is significant since aircraft engines are often arranged either above or below the wing. For theoretical calculations the wing is represented by a flat plate and the engine nacelle by a cylinder composed of source and vortex singularities. The normal velocity components induced on the wing by the nacelle are simulated by additional singularities on the wing in order to obtain a first approximation of the modified pressure distribution. Experimental results are represented for nine wing/nacelle combinations and three angles of attack. Three different intake blockages are also considered. For several cases the theoretical and experimental results are compared. Author (ESA)

N76-24185# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

PARACHUTE DESIGN AND PERFORMANCE DATA BANK Final Report, 1 Jul. 1970 - 30 Dec. 1973

James H. DeWeese and Robert McCarty Jan. 1975 121 p
(AF Proj. 6065)
(AD-A019491; AFFDL-TR-74-45) Avail: NTIS CSCL 01/3

The development and operation of a system for computer-aided design and performance analyses of parachutes are discussed. The rationale used in initial conceptual planning and in establishing the operational procedures employed is included. In addition, the mechanics involved in the information storage and retrieval tasks are presented. The data bank stores only design details and performance data which have been extracted from various sources. A FORTRAN extended program providing highly flexible and very selective retrieval operates on the accumulated information base. Procedures for utilization of the data bank, current project status, and plans are outlined. GRA

N76-24186# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

ANALYSIS OF TRANSONIC VISCOUS-INVISCID INTERACTIONS ON AXISYMMETRIC AFTERBODIES WITH JET EFFECTS AND BOATTAIL INJECTION IN SEPARATED REGIONS Final Report, Jun. 1974 - Apr. 1975

Wladimiro Calarese Sep. 1975 77 p refs
(AF Proj. 1476)
(AD-A018865; AFFDL-TR-75-117) Avail: NTIS CSCL 20/4

The transonic flow with viscous-inviscid interactions over axisymmetric afterbodies is analyzed. Viscous effects are considered and iterated with the inviscid solution of the non-linear small perturbation equation. The jet flow is simulated by a sting-cone frustum combination. For boattail flow separation, the shear flow properties and the viscous mixing are calculated using a Korst base flow type of analysis. Boattail mass and energy injection are used in the separated region to obtain a favorable interference with the inviscid flow with consequent drag reduction. A complete program listing is provided. The program can be used for subsonic free stream Mach number and zero angle of attack. Author (GRA)

N76-24187# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
SIMILITUDE PROPERTIES OF HIGH SPEED LAMINAR AND TURBULENT BOUNDARY LAYER INCIPIENT SEPARATION Interim Report
George R. Inger Sep. 1975 49 p refs
(Contract N60921-74-C-0213)
(AD-A019149; VPI-Aero-037) Avail: NTIS CSCL 20/4

Following a brief review of existing experimental knowledge about the important parameters in influencing high speed boundary layer separation, a systematic analysis is made of the various similitude rules pertaining to incipient separation including viscous-inviscid interaction for both laminar and turbulent flows. For supersonic and hypersonic turbulent flows a new scaling rule is derived which, unlike existing ones, agrees with the general trend of experimental data at high Reynolds numbers. The corresponding lateral pressure gradient effects are also examined and shown to be significant for such turbulent flows throughout the entire speed range. GRA

N76-24188# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
AERODYNAMIC ANALYSIS OF A GENERAL PURPOSE TOW TARGET (NEW CONFIGURATION)
J. B. Smith 21 Oct. 1975 22 p refs
(AD-A018699; NADC-75124-30) Avail: NTIS CSCL 01/3

This report presents the aerodynamic characteristics of a proposed aerial tow target configured to meet the general purpose tow target requirements of the Navy Standard Tow Target System. The General Purpose Tow Target will serve as a target for missile and gunnery weapon firing exercises and will be capable of air launch and recovery. GRA

N76-24189# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AERODYNAMIC FORCES ON A BLUNT STORE RELEASED FROM A SWEPT WING M.S. Thesis
Robert A. Grow 19 Dec. 1975 103 p refs
(AD-A019330; GAE/MD/75D-6) Avail: NTIS CSCL 01/1

The analysis of the forces on a body released from an aircraft is separated into two categories: The analysis of the flow around a wing; and the analysis of a body in a non-uniform flow field. The flow around a wing was determined using a vortex lattice on a flat plate wing with constant sweep angles. The body was modelled by an ellipsoid of revolution forebody, and a paraboloid of revolution afterbody. The axial flow velocities were determined by using slender body theory for axial flow, except in the region of the blunt nose and tail. The cross flow velocities, and the axial flow velocities near the nose and tail were determined by computing the flow around spheres tangent to the body at every control point. Drag was simulated for potential theory by artificially accelerating the flow on the leeward side of the spheres. GRA

N76-24190# Naval Intelligence Support Center, Washington, D.C. Translation Div.
APPROXIMATE METHOD OF CALCULATING THE INTERACTION OF FINITE-SPAN AIRFOILS IN UNSTEADY MOTION ABOVE A SOLID SURFACE
V. K. Treshkov 26 Nov. 1975 9 p refs Transl. into ENGLISH from Tr. Leningrad Korablestroitelnyi Inst. (Leningrad), v. 80, 1972 p 87-92
(AD-A019222; NISC-Trans-3718) Avail: NTIS CSCL 01/1

The interaction of the wing and tail assembly in unsteady motion is examined. An approximate method developed to determine the aerodynamic characteristics of the system is presented. J.M.S.

N76-24210 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
TRANSONIC PROBLEMS IN ROTOR AERODYNAMICS [TRANSSONIKPROBLEME DER ROTORAERODYNAMIK]
S. Wagner *In* DGLR Contrib. to Helicopter Technol. 21 Nov. 1975 p 11-52 refs In GERMAN (For availability see N76-24209 15-05)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-24191# Control Data Corp., St. Paul, Minn. Advanced Systems Div.
AIRCRAFT PILOT WARNING INSTRUMENT (APWI) STUDY Final Report
W. Graham Mar. 1975 167 p refs
(Contract DOT-FA70WA-2263)
(AD-A022621/7; FAA-RD-75-59-Vol-I) Avail: NTIS HC $6.75 CSCL 01/4

The factors by which the expected number of collisions could be reduced by the implementation of Proximity Warning Instruments (PWI) having various performance characteristics are estimated. If both aircraft involved in an encounter are equipped with high performance PWI (sharp range and altitude cut-offs, and 2 deg relative bearing accuracy) then it is estimated that the expected rate of collision itself is estimated to be highly effective, as judged by the number of potential collisions that are avoided, but the residual collision risk is unacceptable to the public and large effort is being made to mitigate it. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N76-24192# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
AREA NAVIGATION HIGH ALTITUDE PAYOFF ANALYSIS ENROUTE FAST TIME SIMULATION RESULTS Final Report, Jan. 1973 - Sep. 1975
Ricardo Cassell Dec. 1975 111 p refs
(AD-A022993/0; FAA-RD-76-26) Avail: NTIS HC $8.00 CSCL 17/7

A series of fast time simulations of high altitude route structures were conducted. System/user payoff conclusions are presented based on the results of the simulations and observations by the author. While the limitations of fast time simulation resulting from the lack of controller intervention effects are recognized, the simulation techniques employed provide, as a minimum, a substantial basis for the identification of well marked trends and a sizeable data base upon which a reasonable degree of confidence can be placed. Author

N76-24193# Purdue Research Foundation, Lafayette, Ind. School of Electrical Engineering.
APPLICATION OF BALANCED LINES, TONE SIGNALING, AND MICROPROCESSOR CONTROL TECHNIQUES TO A CATEGORY 3 INSTRUMENT LANDING SYSTEM Interim Report
S. C. Bass Feb. 1976 112 p refs
(Contract DOT-FA74WA-3518)
(AD-A022620/9; FAA-RD-76-24) Avail: NTIS HC $5.50 CSCL 01/2

The purpose of this partial system design and installation was to evaluate the electromagnetic interference susceptibility and reliability of a microprocessor controlled CAT three ILS monitor and control interface technique using balanced lines and tone signaling techniques. Implementation and evaluation of these techniques as applied to a partial system is discussed. A full system test is planned under a follow-on program. Details of

the results and plans for the full system are contained in the report. Author

N76-24194# National Aviation Facilities Experimental Center, Atlantic City, N.J.
IMPROVEMENT TO DOPPLER VOR SIDEBAND ANTENNA MONITOR, TYPE FA-8142 Final Report, Jun. 1974 - Aug. 1975
James G. Dong Feb. 1976 31 p refs
(AD-A022953/4; FAA-NA-75-57; FAA-RD-76-4) Avail: NTIS HC $4.00 CSCL 17/7

A Doppler very high frequency omnidirectional radio range (DVOR) Sideband Antenna Monitor was investigated to determine methods of eliminating the possibly unreliable operation when an antenna fault occurs. Minor modifications were made in the monitor to improve adjustment. Tests were accomplished in the Doppler No. 2 site at the National Aviation Faciilities Experimental Center (NAFEC). Included in the investigation was the operation of the monitor with a slotted cylinder antenna. The test results indicate that the most reliable monitor operation was obtained with the modified monitor using a slotted-cylinder antenna coaxially located above the carrier antenna. Author

N76-24195# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MLS MULTIPATH STUDIES. VOLUME 1: MATHEMATICAL MODELS AND VALIDATION
J. E. Evans, R. Burchsted, J. Capon, R. S. Orr, D. A. Shnidman, and S. M. Sussman 25 Feb. 1976 253 p refs
(Contracts DOT-FA74WAI-461; F19628-76-C-0002)
(AD-A023040/9; ATC-63-Vol-1; FAA-RD-76-3-Vol-1) Avail: NTIS HC $9.00 CSCL 01/2

Mathematical models are given for the major Microwave Landing System (MLS) multipath sources (ground reflections, building and aircraft reflections, and shadowing by objects and humped runways), and it is shown that they agree well with field data (including the Lincoln measurements at Logan Airport). Models for the techniques (Doppler and scanning beam) considered in phase II of the U.S. MLS program are presented together with validation by comparison with theory and bench tests. Also presented are the results of a general study in motion averaging. Author

N76-24196# Lincoln Lab., Mass. Inst. of Tech., Lexington.
BEACON CAS (BCAS): AN INTEGRATED AIR/GROUND COLLISION AVOIDANCE SYSTEM
V. A. Orlando and J. D. Welch 23 Mar. 1976 20 p
(Contracts DOT-FA72WAI-261; F19628-76-C-0002)
(AD-A023035/9; FAA-RD-76-2; ATC-62) Avail: NTIS HC $3.50 CSCL 17/7

The beacon collision avoidance system (BCAS) is a discrete address beacon system (DABS) based airborne collision avoidance system that exploits the features of DABS discrete addressing and integral data link. This provides for a CAS with the unique capabilities of (1) cooperative threat resolution between BCAS and conflicting aircraft through the transmission of maneuver intent (to DABS-only aircraft) and tie breaking (with other BCAS aircraft)and (2) coordination of CAS activities with the ground ATC control function through the DABS air-ground-air data link. All beacon-equipped aircraft in the vicinity of the BCAS are detected. The ATCRBS-equipped aircraft are interrogated using a special Mode C interrogation. The DABS aircraft are detected passively through periodic squitters emitted by all DABS transponders. Squitter-detected aircraft are tracked on altitude and only those aircraft that represent a co-altitude threat are discretely interrogated to establish a range/altitude track. The use of discrete addressing eliminates synchronous garble for the BCAS in the same manner as for DABS. A general description is given of BCAS from the viewpoint of its operational features and the avionics package required to achieve this capability is described. Author

N76-24197# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIRPORT SURVEY FOR MLS MULTIPATH ISSUES
D. A. Shnidman 15 Dec. 1975 84 p refs
(Contracts DOT-FA74WAI-461; F19628-76-C-0002)
(AD-A022937/7; FAA-RD-75-195; ATC-58) Avail: NTIS HC $5.00 CSCL 17/7

Eight major U.S. civilian airports were visited and data on the surface material of all sizable buildings visible from the runways were obtained. This information is catalogued. A total of 93 buildings and 123 surfaces are included and the breakdown between the various surfaces is as follows: 74 surfaces were corrugated; 17 surfaces were cinder block; 16 surfaces were brick; 9 surfaces were concrete; and 5 surfaces were smooth metal. Of the 74 corrugated surfaces 18 were of the flat variety, 34 were one of five sub-categories and the remaining 22 needed 15 sub-categories for classification. Author

N76-24198# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
DESIGN OF A QUICK-LOOK METHOD FOR DLS REFERENCE TRAJECTORY DETERMINATION USING KALMAN FILTERING (RADAR SUPPORTED INS) [DER ENTWURF EINES QUICK-LOOK-VERFAHRENS FUER DIE DLS-REFERENZBAHN-BESTIMMUNG MITTELS KALMAN-FILTERUNG (RADARGESTUETZTES INS)]
W. Hofmann 15 Sep. 1975 55 p refs In GERMAN
(DLR-IB-75/10) Avail: NTIS HC $4.50

A quick-look program was developed for the fast evaluation of the reference trajectory of an aircraft backed by a distance measurement equipment based landing system (DLS). The position information used for the quick-look method includes radar measurements with partial high frequency interference and Inertial Navigation System (INS) measurements with partial low frequency interference. The optional combination of this information for estimation of the reference trajectory is achieved by using a Kalman filter. The design of the Kalman filter, (modelling and analysis), a feedback radar supported INS circuit, and the description of the resulting FORTRAN program, are described. ESA

N76-24199# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A FIRST-ORDER, WORLDWIDE, IONOSPHERIC, TIME-DELAY ALGORITHM Air Force Surveys in Geophysics
John A. Klobuchar 25 Sep. 1975 26 p
(AF Proj. 4643)
(AD-A018862; AFCRL-AFSG-324; AFCRL-TR-75-0502) Avail: NTIS CSCL 17/7

A first-order model algorithm designed to reduce ionospheric time-delay errors by approximately 50% rms on a world-wide basis for single frequency users of the Global Positioning System/NAVSTAR is described. The algorithm was designed for greatest accuracy during times of day when ionospheric time-delay errors are expected to be largest. The algorithm is available in several options, from one which requires only a monthly mean solar-flux value to one which requires 9 daily or monthly update coefficients. Several approximations also are made in the geometry calculations to further reduce operational user computer storage and running time requirements. Author (GRA)

N76-24200# Advisory Group for Aerospace Research and Development, Paris (France).
PRACTICAL ASPECTS OF KALMAN FILTERING IMPLEMENTATION
Mar. 1976 186 p refs
(AGARD-LS-82) Avail: NTIS HC $7.50

Application of Kalman filtering to guidance and control is investigated. Emphasis is placed on inertial navigation systems for aircraft. For individual titles, see N76-24201 through N76-24207.

N76-24201 Analytical Mechanics Associates, Inc., Mountain View, Calif.
EXPERIENCES IN THE DEVELOPMENT OF AIDED INS FOR AIRCRAFT
Stanley F. Schmidt *In its* Pract. Aspects of Kalman Filtering Implementation Mar. 1976 21 p refs (For availability see N76-24200 15-04)

Experiences in the development and test evaluation of Kalman filters in aided navigation systems for aircraft are presented. Designs for two operational systems for enroute-navigation uses and two experimental systems for terminal area and landing uses are described. The primary emphasis is on the developmental approach used with examples from the actual designs. Practical

considerations are stressed rather than the mathematical formulations and theory. Details are presented on the square-root implementation of the Kalman filter which is used in three of the actual systems. Problems encountered in actual designs and the solutions selected for these problems are discussed. A brief overview of the possible future trends in aircraft navigation systems is also given. Author

N76-24202 Rockwell International Corp., Anaheim, Calif. Autonetics Group.
PRACTICAL CONSIDERATIONS IN IMPLEMENTING KALMAN FILTERS
John C. Wauer *In its* Pract. Aspects of Kalman Filtering Implementation Mar. 1976 11 p ref (For availability see N76-24200 15-04)

Techniques that are used to implement the Kalman filter for aircraft inertial navigation applications are presented. The applications include AMSA advanced development task flight test, FB-111 and F-111D aircraft avionics, at-sea alignment aboard aircraft carriers, and stationary alignment of electrostatic gyro-strapdown navigation system. Techniques used to simplify the filter model are discussed. The use of random walk and white noise error sources is described. State vector transformations are performed to simplify the filter model. Detection of failures is accomplished by testing the measurements for reasonableness. Computational techniques used in computers with fixed-point arithmetic are discussed. A flexible covariance matrix scaling technique is essential to maintain adequate resolution in a fixed-point computer. Efficient algorithms for covariance matrix and state vector extrapolation and reset are described. Author

N76-24203 Boeing Co., Seattle, Wash.
EXPERIENCES WITH THE B-1 NAVIGATION FILTER
John E. Bergeson *In its* Pract. Aspects of Kalman Filtering Implementation Mar. 1976 26 p refs (For availability see N76-24200 15-04)

Practical aspects of Kalman filter design are discussed. Topics presented include error model definition, software-implementation considerations and flight test verification. Although B-1 navigation filter experiences are emphasized, the discussion is applicable to Kalman filter design for any long-range, high-speed cruise vehicle with similar navigation sensors. Inertial-platform slew-induced phenomena and their implication for filter design are emphasized. Author

N76-24204 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
EXPERIENCES IN FLIGHT TESTING HYBRID NAVIGATION SYSTEMS
Heinz Winter *In its* Pract. Aspects of Kalman Filtering Implementation Mar. 1976 29 p refs (For availability see N76-24200 15-04)

Experiences gained in error modeling for navigation sensors; designing filters for hybrid navigation systems; sensitivity analysis of these filters; building up high precision reference systems for the flight tests; flight testing hybrid navigation systems; and evaluating the flight test results are described. The navigation accuracies of Doppler-inertial and baro-inertial systems, derived from theoretical analysis and flight tests, are given. Author

N76-24205 Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
DESIGN AND DEVELOPMENT OF KALMAN FILTERS NAVIGATION SYSTEMS [ETUDE ET REALISATIONS DE FILTRES DE KALMAN POUR SYSTEMES DE NAVIGATION]
Pierre Faurre and Loie Camberlein *In its* Pract. Aspects of Kalman Filtering Implementation Mar. 1976 42 p refs In FRENCH; ENGLISH summary (For availability see N76-24200 15-04)

Two systems using Kalman filtering are described. A hybrid inertial-Doppler-position reset navigator was studied and experimented from 1967 to 1972. The numerical algorithms were studied and implemented with care. The complete program was split into two computers, and the subprogram corresponding to the filter represented about 6,000 words, over 11,000 for the total. Curves are given both for theoretical performances, and for experimental flight results. Algorithms and software for optimal alignment of an inertial platform were developed and tested from 1972 to 1974. The inertial system used for the experiment is an MGC 30. The mathematical model is quite simple, and the complete alignment program uses 1,800 words. The improvement in alignment time is quite impressive: 450 seconds for optimal alignment, to be compared to 1,031 seconds for classical alignment. Author

N76-24206 Le Petit Monthelon, Acigne (France).
A SHIP TRACKING SYSTEM USING A KALMAN-SCHMIDT FILTER
Claude A. Darmon *In its* Pract. Aspects of Kalman Filtering Implementation Mar. 1976 24 p refs (For availability see N76-24200 15-04)

The digital processing is described of measurements at a high accuracy ship-tracking system. The errors affecting the azimuth measurement supplied by the measuring device of the ground-based station are found to be the most critical for the overall accuracy of the system. A Kalman-Schmidt filter is selected for an optimum estimation of the azimuth speed, following comparisons with a Kalman filter and an averageing filter. The estimation of the navigation parameters is described and the position and speed accuracy achieved by the system is calculated. Moreover, various effects resulting from the data processing in a computer are analyzed and optimized: for instance choice of the computation rate for the azimuth velocity, scaling of navigation parameters, etc. Finally, the programming of the data processing in a microcomputer is described and evaluated from two standpoints: memory space requirement and computation time. The results obtained confirm the efficiency of the solutions selected. Author

N76-24207 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DESIGN AND ANALYSIS OF LOW-ORDER FILTERS APPLIED TO THE ALIGNMENT OF INERTIAL PLATFORMS
Willi Kortuem *In its* Pract. Aspects of Kalman Filtering Implementation Mar. 1976 26 p refs (For availability see N76-24200 15-04)

The typical steps and considerations for designing low-order efficient state estimators or Kalman filters are described. The design steps are demonstrated on a platform alignment problem where Kalman filtering is used rather than conventional procedures to reduce the time necessary for the required alignment accuracy. The work reported is based on a test series for modelling gyro-drift and accelerometer errors. The selection of a design model for the filter, the filter design itself, and a complete covariance analysis are emphasized. The main goal of the filter design is to achieve a simple, i.e., low-order insensitive design. Author

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.
For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-24208*# Calspan Corp., Buffalo, N.Y.
EVALUATION OF XV-15 TILT ROTOR AIRCRAFT FOR FLYING QUALITIES RESEARCH APPLICATION Final Report, Jun. - Dec. 1975
Robert C. Radford, Arno E. Schelhorn, Ralph J. Siracuse, Robert D. Till, and Richard Wasserman Apr. 1976 132 p refs Sponsored in part by USAAMRDL
(Contract NAS2-8855)
(NASA-CR-137828; AK-5752-F-1) Avail: NTIS HC $6.00 CSCL 01C

The results of a design review study and evaluation of the XV-15 Tilt Rotor Research Aircraft for flying qualities research application are presented. The objectives of the program were to determine the capability of the XV-15 aircraft and the V/STOLAND system as a safe, inflight facility to provide meaningful research data on flying qualities, flight control systems, and information display systems. Author

N76-24209# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
CONTRIBUTIONS TO HELICOPTER TECHNOLOGY
DFVLR 21 Nov. 1975 185 p refs In GERMAN; ENGLISH summary Proc. of the Meeting of the DGLR Sci. Comm. 2A2 on Rotary Wing Aircraft, Stuttgart, 18 Oct. 1974
(DLR-MITT-75-24) Avail: NTIS HC $7.50; DFVLR, Cologne DM 66.40

Developments in helicopter technology are discussed. Topics covered are: problems of transonic flow in rotor aerodynamics, possibilities and problems of noise reduction, special problems with the identification of flight dynamic parameters of helicopters, application of ground vibration test methods to the solution of aeroelastic problems of V/STOL-rotary wing aircraft, configuration and flight mechanics of a ship-based, unmanned rotor platform, and studies for a twin-rotor helicopter configuration with utilization of the aerodynamic potential of the advancing rotor blade. For individual titles, see N76-24210 through N76-24214.

N76-24210 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
TRANSONIC PROBLEMS IN ROTOR AERODYNAMICS [TRANSSONIKPROBLEME DER ROTORAERODYNAMIK]
c02
S. Wagner *In* DGLR Contrib. to Helicopter Technol. 21 Nov. 1975 p 11-52 refs In GERMAN (For availability see N76-24209 15-05)

The rotor-blade supersonic regions and position of the compression shocks were determined for transonic flow over the circular rotor disk and over the advancing blade using a blade element theory. The resulting aerodynamic problems, and the technology for resolving these, are discussed. The following proposals are made for improving the present knowledge gap in this field: investigation of feasibility of supercritical rotor profiles; construction of appropriate throughflow models in 3-D computation methods for more exact evaluation of local flow conditions, especially for transonic flow; further development of the 3-D relaxation method for calculation of transonic aerodynamics of the rotor blade; and pressure distribution measurements of rotors for better understanding of the physics, especially at transonic flow. ESA

N76-24211 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
POSSIBILITIES AND PROBLEMS OF HELICOPTER NOISE REDUCTION [MOEGLICHKEITEN UND PROBLEME DER LAERMMINDERUNG AM HUBSCHRAUBER]
V. Langenbucher and E. Laudien *In its* Contrib. to Helicopter Technol. 21 Nov. 1975 p 53-100 refs In GERMAN (For availability see N76-24209 15-05)

The generation mechanisms of helicopter noise radiation are discussed, and possibilities for reduction of the essential mechanical and aerodynamic noise sources are surveyed. External rotor noise can be reduced by a different layout of both rotors, leading to a weight and performance penalty. Also aerodynamic improvements of rotors are possible. Mechanical noise sources are mainly responsible for internal noise. Cabin noise can be reduced by reduction of the sound emission of individual noise sources, structural measures, and the use of sound absorbing material in cabin linings. ESA

N76-24212 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
STATIC VIBRATION TESTS FOR RESOLVING AEROELASTIC PROBLEMS OF V/STOL ROTARY WING AIRCRAFT [ANWENDUNG DER STANDSCHWINGUNGSTECHNIK BEI DER LOESUNG AEROELASTISCHER PROBLEME VON V/STOL-DREHFLUEGELFLUGZEUGEN]
F. Kiessling *In* DGLR Contrib. to Helicopter Technol. 21 Nov. 1975 p 105-130 refs In GERMAN (For availability see N76-24209 15-05)

Proposals are made for static vibration testing methods of V/STOL rotary wing aircraft. A static vibration test was used to determine self vibration forms of a weakly damped elastic structure with the associated modal characteristics. The principles of this test are detailed, accentuating a phase resonance method. For V/STOL rotary wing aircraft, the rotation of the elastic rotors provokes additional effects such as gyroscopic coupling and variations of the blade stiffness by centrifugal forces. These should be considered in often very complicated analytical models. Proposals are based on these concepts. Correction terms are given for the effects of the rotating parts, which can be calculated from test results of nonrotating rotors. ESA

N76-24213 Dornier-System G.m.b.H., Friedrichshafen (West Germany).
CONCEPTION AND FLIGHT MECHANICS OF A SHIP-SUPPORTED UNMANNED ROTOR PLATFORM [BEITRAEGE ZUR KONZEPTION UND FLUGMECHANIK EINER SCHIFFSGESTUETZTEN UNBEMANNTEN ROTORPLATTFORM]
G. Engel *In* DGLR Contrib. to Helicopter Technol. 21 Nov. 1975 p 131-144 In GERMAN (For availability see N76-24209 15-05)

The conception of an unmanned rotor platform attached to a ship by means of a 300 m tetherline (umbilical connection), for reconnaissance and navigation, is discussed. A captive rotor platform can carry not only sea radar but also other sensors and sensor combinations, such as data communication relay equipment. The platform is compared to other air support, such as helicopters; the possibility of long flight durations is emphasized. Flight mechanics of the platform are described. ESA

N76-24214 Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
ADVANCED SIDE-BY-SIDE CONCEPT
In DGLR Contrib. to Helicopter Technol. 21 Nov. 1975 p 145-184 In GERMAN (For availability see N76-24209 15-05)

The design of a helicopter with a side-by-side rotor configuration using the aerodynamic potential of the advancing rotor blade is discussed. The object of such configurations is to increase helicopter maximum velocity and maneuverability using established technologies. The concept is analyzed from the points of view of rotor aerodynamics, forces and moments, stability, controllability, geometry, and weight. The advantages of the design as compared to conventional helicopters are enumerated. A proposal is made for an experiment using a modified Bell Jet-Ranger. ESA

N76-24215# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
WEIGHT PREDICTION METHODS - GRUGEW PROGRAM
Dietrich Klein 21 Dec. 1973 161 p refs In GERMAN; ENGLISH summary
(MBB-UFE-1072-0) Avail: NTIS HC $6.75

A computer program for the calculation of group weights for structure, propulsion and equipment was developed for the purpose of weight prediction. The take-off weight is compiled from the addition of weight for payloads, hydraulic fluid and fuel, to the above group weights. The equations included in the existing program may be used for weight prediction in the preliminary design phase of an aircraft project. The compiled group weight is printed out in accordance with MIL-STD 254/451 mod. Group Weight Statement. Author (ESA)

N76-24216# European Space Agency, Paris (France).
GROUND SIMULATION OF FLUTTER ON AIRCRAFT WITH HIGH-ASPECT-RATIO WINGS
Perumal Rajagopal Feb. 1976 54 p refs Transl. into ENGLISH of 'Simulation au Sol du Flottement pour les Avions de Grand Allongement', ONERA, Paris Report ONERA-NT-222, 1974
(ESA-TT-263; ONERA-NT-222) Avail: NTIS HC $4.50

A method is proposed for the simulation of the unsteady aerodynamic forces which act upon an aircraft in flight by means of an electromechanical apparatus. The principle is as follows: the aircraft being on the ground, an electronic circuit is used to calculate the aerodynamic forces from the accelerations measured on the structure and to transmit the results of the calculations to exciters. The analog computer linking the forces to the exciters includes a potentiometer on which the speed parameter may be set. The evolution in the damping phenomena may readily be monitored on a cathode screen. The advantage of this method is that it is not necessary to measure either the generalized aircraft parameters or its deformations. Also implicit allowance

is made for the nonlinearities of the structure, since the test takes place on the structure itself. A test on a model is described and compared with a classical flutter calculation. The results are very encouraging. Author (ESA)

N76-24217# Naval Surface Weapons Center, White Oak, Md.
HOVERCRAFT RIGID BODY RESPONSE TO FREE FIELD AIRBLAST
J. M. Ward 28 Oct. 1975 67 p
(DNA Proj. NWED-QAXND013)
(AD-A018856; NSWC/WOL/TR-75-42) Avail: NTIS CSCL 13/10

Vehicles in the class of surface effect ships (SES) and air cushion vehicles (ACV) respond to airblast loading in a manner different from that of conventional displacement-type ships. The SES/ACV class of vehicles has low hydrodynamic drag resistance to motion response, and the air cushion chamber which levitates the vehicles can interact with the blast wave. The rigid body response of a hovercraft (ACV) in an airblast environment was investigated by conducting free field HE explosive tests. The airblast loading was of short duration (25-35 msec free field positive phase). The results are discussed. GRA

N76-24218# Dayton Univ., Ohio. Research Inst.
DEVELOPMENT OF FLIGHT-BY-FLIGHT FATIGUE TEST DATA FROM STATISTICAL DISTRIBUTIONS OF AIRCRAFT STRESS DATA, VOLUME 1 Final Report
George J. Roth AFFDL May 1975 138 p refs
(Contract F33615-73-C-3007; HF136703)
(AD-A016406; AFFDL-TR-75-16-Vol-1) Avail: NTIS CSCL 20/11

Axially loaded specimens of 7075-T651 aluminum with a hole were fatigue tested using loading histories derived from strain gage data recorded on operational aircraft. For the baseline data the magnitude and order in which the loads occurred during a flight were preserved. The flight contained data from taxi, takeoff, flight and landing strain histories. The data were processed by several counting techniques to obtain statistical distributions of the cyclic and mean stress amplitudes, as well as the number of stress cycles per flight for both the ground operations and the inflight operations. These distributions were then used to generate a series of flight-by-flight test sequences. Three different counting techniques were used to determine the statistical distribution of the cyclic stress for each of two aircraft types. The report presents the results in terms of the number of flights to failure for 9 sequences of B-58 data and 6 sequences for the F-106 data. A total of 91 specimens were tested. The report concludes that simulated testing sequences can yield the same fatigue life as the original strain gage data recorded on operational aircraft. GRA

N76-24219# Dayton Univ., Ohio. Research Inst.
DEVELOPMENT OF FLIGHT-BY-FLIGHT FATIGUE TEST DATA FROM STATISTICAL DISTRIBUTIONS OF AIRCRAFT STRESS DATA. VOLUME 2: DOCUMENTATION OF THE B-58 AND F-106 FATIGUE SPECTRA SIMULATION PROGRAM Final Report, Oct. 1972 - Jan. 1974
Michael C. Hill AFFDL May 1975 405 p
(Contract F33615-73-C-3007)
(AD-A016407; AFFDL-TR-75-16-Vol-2) Avail: NTIS CSCL 20/11

This report documents the computer programs and subroutines written in support of the effort presented in Volume I. The report describes and documents two aircraft simulation programs used to process flight loads data derived from B-58 and F-106 aircraft flying operational missions. A simulation merge program is also included which combines the output tapes from the aircraft simulation programs and generates an output tape compatible with the hybrid computer. The program listings and sample problems for the simulation programs are presented in the Appendices. GRA

N76-24220# Human Engineering Labs., Aberdeen Proving Ground, Md.
A COMPARISON OF THE LIGHT DISTRIBUTION OF EXTERNALLY-LIT AND INTEGRALLY-LIT LIGHTING SYSTEMS
Alan M. Poston Dec. 1975 13 p refs
(AD-A019004; HEL-TN-11-75) Avail: NTIS CSCL 13/1

A statistical analysis was performed to determine if there are any differences between externally-lit and integrally-lit (wedge) lighting systems. The light distribution in an existing OH-58 helicopter was compared against two OH-58 helicopters which had their lighting systems modified to an integrally-lit lighting system for another study. The ratio of the standard deviation to mean value was computed for each instrument and the statistical analysis was performed on this ratio. GRA

N76-24221# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
PARAMETRIC TRADE-OFF STUDY FOR DESIGN OF A FULL SIZE ANTI-SHIP MISSILE DEFENSE TOW TARGET
J. B. Smith 21 Oct. 1975 36 p refs
(AD-A018698; NADC-75098-30) Avail: NTIS CSCL 01/3

A parametric trade-off study has been conducted, the results of which are intended for use in the design of a full size Anti-Ship Missile Defense tow target. The effects of various configuration parameters on such target characteristics as drag, stability, space for equipment, and visibility were determined; the resulting relationships are discussed and shown by means of working equations and/or plots in this report. GRA

N76-24222# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
NAVY JET TRAINER (VTX) CONCEPTUAL DESIGN STUDIES
W. E. Becker 10 Dec. 1975 76 p refs
(AD-A018779; NADC-75198-30) Avail: NTIS CSCL 01/3

The VTX aircraft is intended to fill the future trainer role for basic and advanced flight training of Navy undergraduate jet pilots. The vehicle design studies include definition of a baseline VTX configuration and examination of take-off gross weight sensitivity to six performance/design parameters (sustained maneuvering load factor, service ceiling, avionics payload, structural limit load factor, maximum speed, and range). Vehicle design synthesis and performance estimation are accomplished with the aid of HIPERAC, a tactical aircraft design tool developed by NAVAIRDEVCEN. The VTX vehicle design serves principally as a tool for examining the design implications of preliminary requirements proposed for Navy jet trainer aircraft. Initially, three driving performance requirements (sustained maneuverability, take-off distance, and landing distance) and a fuel-critical mission (Low Level Operational Navigation) are identified, then a vehicle configuration is developed to satisfy these constraints. The take-off gross weight of this vehicle is 12,235 lbs., and it is powered by two turbofan engines of 3,475 lbs. rated thrust apiece. Maximum Mach number is 0.84 at 30,000 ft. altitude, maximum sustained normal acceleration at 18,000 ft. is 4g's, service ceiling is 52,700 ft., and maximum range is 1,573 n. mi. Takeoff gross weight is particularly sensitive to increases in sustained load factor, maximum speed, and service ceiling but much less sensitive to reductions in these parameters because reduced weight design solutions are bounded by the take-off distance constraint.
Author (GRA)

N76-24223# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
CATAPULT LAUNCH FATIGUE INVESTIGATION OF THE MODEL E-1B/C-1 AIRPLANE Final Report
H. D. Lystad 19 Nov. 1975 51 p
(AD-A019519; NADC-75310-30) Avail: NTIS CSCL 01/3

A laboratory fatigue investigation was performed on an E-1B fuselage with a reinforced catapult keel to determine if it could sustain the loads associated with 3,000 catapult launches. The bulkhead at fuselage station 135 failed after 8,420 test cycles of the catapult start of run condition. Using a test scatter factor of 2, this is equivalent to 4,210 service catapult launches. The holdback structure failed after 8,188 test cycles of the catapult release condition. Again, using a test scatter factor of 2, this is equivalent to 4,094 service catapult releases. GRA

N76-24224# Informatics, Inc., Rockville, Md.
SOVIET AND EAST EUROPEAN DEVELOPMENTS IN SURFACE EFFECT VEHICLES
L. H. Boylan 30 Nov. 1975 84 p refs
(Contract MDA903-76-C-0099; DARPA Order 3097)

(AD-A018738) Avail: NTIS CSCL 01/3

The purpose of this report is to provide an overview of the history and state of the art of Soviet and East European developments in surface effect vehicles. Part I reviews 22 vehicles which were designed or built between 1927 and the mid 1960's. Part II of the report focuses on the operational surface-effect vehicles of the Soviet Union, Bulgaria, Poland and Romania. Air lubricated vessels are not covered in this report. Author (GRA)

N76-24225# IIT Research Inst., Chicago, Ill.
RELIABILITY ASSESSMENT OF MODIFIED FIELDED AIRCRAFT USING THE BAYESIAN TECHNIQUE Final Report, Feb. - Nov. 1975
Vernon D. Allen and N. Thomompoulos 15 Nov. 1975 71 p
(Contract DAAJ01-75-C-0307)
(AD-A018890; USAAVSCOM-TR-75-50) Avail: NTIS CSCL 01/3

This manual provides a detailed description of the methodology and computer code developed for the U.S. Army Aviation Systems Command (AVSCOM) which estimates reliability and mean-time-between-failure (MTBF) of an aircraft system using Bayesian methods. The computer code calculates MTBF, cost and reliability for each item of the aircraft system based on the historical data alone, and by Bayes theory, which combines the historical data with the test data. Author (GRA)

N76-24226# Army Electronics Command, Fort Monmouth, N.J.
DATA ACQUISITION AND TEST TEAM CAPABILITIES REPORT
E. Tognola, J. Maguire, and M. Bereschinsky Dec. 1975 44 p
(DA Proj. 1F2-64201-DC-97)
(AD-A018995; ECOM-4381) Avail: NTIS CSCL 01/3

This report describes the data acquisition and reduction capabilities that are being provided by the Data Acquisition and Test Team, Aircraft Installation and Test Technical Area, Avionics Laboratory located in Fort Monmouth, N.J. The operating characteristics of each of the data acquisition systems are outlined ranging from a small cassette datalogger to a large scale, high speed, high density recording system. The data reduction capability is described in two sections: the Data Formatting Facility, which transcribes airborne recorded data onto computer compatible tapes; and the software capability, which provides data reduction and analysis programs for both mini- and large-scale computers. The report concludes with descriptions of past and present projects illustrating the applications of the various data acquisition systems. GRA

N76-24227# Rockwell International Corp., Columbus, Ohio. Columbus Div.
T-28 SERVICE LIFE EVALUATION Quarterly Report
J. G. Hutcheson and J. J. Gruff 18 Aug. 1975 61 p Revised
(Contracts N000156-73-C-0152; N062269-74-C-0718)
(AD-A018907; NR73H-35; QR-8) Avail: NTIS CSCL 01/3

In this report a meeting at NARF-Pensacola on the NIFTS program is briefly reviewed, wind lug crack propagation test results are re-evaluated to determine maximum periods between NDI inspections, and procedures for evaluation of T-28B/C service lives are revised per previous discussions with NADC personnel. In addition, the report presents a statistical summary of T-28B/C landing data and an evaluation of recent USAF full scale fatigue tests on a T-28D-5 airplane in terms of Navy T-28 operations. GRA

N76-24228# New Mexico Inst. of Mining and Technology, Socorro.
MODIFICATION OF DRONE SAILPLANE INTO A SPECIAL PURPOSE TEST VEHICLE FOR ATMOSPHERIC RESEARCH Final Report, 1 Jan. 1974 - 30 Jun. 1975
C. B. Moore and J. W. Bullock 4 Nov. 1975 52 p
(Contract N00014-67-A-0267-0009; NR Proj. 211-194; RR0330301)
(AD-A019436) Avail: NTIS CSCL 01/3

A powered sailplane, drone, excess to a U.S. Air Force program, has been converted into a special purpose piloted test vehicle for atmospheric research. The converted aircraft was used in support of the Apollo-Soyuz space flight in July 1975 and in Navy-sponsored thunderstorm research. GRA

N76-24229# Lockheed-California Co., Burbank.
THE DEVELOPMENT OF AN ADVANCED ANTI-ICING/DEICING CAPABILITY FOR US ARMY HELICOPTERS. VOLUME 1: DESIGN CRITERIA AND TECHNOLOGY CONSIDERATIONS Final Report, 30 Jun. 1973 - 30 Jun. 1975
J. B. Werner Nov. 1975 255 p refs
(Contract DAAJ02-73-C-0107; DA Proj. 1F2-62209-AH-76)
(AD-A019044; LR-27180-Vol-1; USAAMRDL-TR-75-341)
Avail: NTIS CSCL 01/3

The work which has been accomplished under this program is reported in two volumes. Volume 1 discusses (1) icing severity level analysis and recommended design criteria, (2) adverse weather protection technology, (3) a trade-off comparison of different types of ice protection systems for various categories of helicopters, and (4) a technology development program for an advanced electrothermal deicing system. Volume 2, Ice Protection System Application to the UH-1H Helicopter, describes the application of the recommended electrothermal deicing system to a UH-1H test aircraft. It provides a detailed description of the modifications to the basic aircraft (including the flight test-instrumentation) and the results of the ground and flight test program for that aircraft conducted in the winter of 1975-75. GRA

N76-24230# Lockheed-California Co., Burbank.
THE DEVELOPMENT OF AN ADVANCED ANTI-ICING/DEICING CAPABILITY FOR US ARMY HELICOPTERS. VOLUME 2: ICE PROTECTION SYSTEM APPLICATION TO THE UH-1H HELICOPTER Final Report, 30 Jun. 1973 - 30 Jun. 1975
J. B. Werner Nov. 1975 222 p
(Contract DAAJ02-73-C-0107; DA Proj. 1F2-62209-AH-76)
(AD-A019049; LR-27180-Vol-2; USAAMRDL-TR-75-34B)
Avail: NTIS CSCL 01/3

For abstract, see Vol. 1, N76-24229.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-24231*# Rensselaer Polytechnic Inst., Troy, N.Y. Systems Engineering Div.
RESEARCH IN DIGITAL ADAPTIVE FLIGHT CONTROLLERS Final Report
Howard Kaufman Washington NASA May 1976 98 p refs
(Grant NGR-33-018-183)
(NASA-CR-2684) Avail: NTIS HC $5.00 CSCL 01C

A design study of adaptive control logic suitable for implementation in modern airborne digital flight computers was conducted. Both explicit controllers which directly utilize parameter identification and implicit controllers which do not require identification were considered. Extensive analytical and simulation efforts resulted in the recommendation of two explicit digital adaptive flight controllers. Interface weighted least squares estimation procedures with control logic were developed using either optimal regulator theory or with control logic based upon single stage performance indices. Author

N76-24232*# Old Dominion Univ., Norfolk, Va. School of Engineering.
EXPERIMENTAL STUDIES ON THE AERODYNAMIC PERFORMANCE AND DYNAMIC RESPONSE OF FLOW DIRECTION SENSING VANES
P. S. Barna and Gary R. Crossman Washington NASA May 1976 124 p refs
(Grant NsG-1143)
(NASA-CR-2683; Rept-75-T7) Avail: NTIS HC $5.50 CSCL 01A

Systematic investigations were performed on a variety of aerodynamic surfaces to obtain their potential for possible application to wind vanes. Among the surfaces tested were: (1) single vanes consisting of flat plates of various planforms having

aspect ratios between 0.5 and 5; (2) bi-vanes with aspect ratio 2.5; (3) various cone and box vanes; and (4) various cruciform configurations. The models were subjected to windtunnel tests. In addition to lift and drag force measurements, damping and frequency test were performed under a variety of flow conditions. Author

N76-24606 Bird Engineering-Research Associates, Inc., Vienna, Va.
EXPERIENCED IN-FLIGHT AVIONICS MALFUNCTIONS
George T. Bird and G. Ronald Herd *In* AGARD Avionics Design for Reliability Mar. 1976 10 p (For availability see N76-24602 15-38)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-24233# Tennessee Univ. Space Inst., Tullahoma.
INVESTIGATION OF FEASIBLE NOZZLE CONFIGURATIONS FOR NOISE REDUCTION IN TURBOFAN AND TURBOJET AIRCRAFT. VOLUME 1: SUMMARY AND SELECTED MULTINOZZLE CONFIGURATIONS Final Report, Jun. 1972 - Jul. 1975
B. H. Goethert, J. R. Maus, W. A. Dunnill et al Jul. 1975 336 p refs
(Contract DOT-FA72WA-3053)
(AD-A019645/1; FAA-RD-75-163-Vol-1) Avail: NTIS HC $9.25 CSCL 17B

Techniques were developed for reducing the noise generated by high velocity jet streams exhausting from a wide variety of nozzle configurations. In addition to exploring techniques for noise suppression and/or redirection, emphasis was placed on investigating the physical mechanisms at work in the generation, suppression, and redirection of aerodynamic noise. An overall summary of the work, a description of the facilities used, and a description of the results obtained on linear arrays of circular nozzles and dual nozzles with shrouds are given. Author

N76-24234# Tennessee Univ. Space Inst., Tullahoma.
INVESTIGATION OF FEASIBLE NOZZLE CONFIGURATIONS FOR NOISE REDUCTION IN TURBOFAN AND TURBOJET AIRCRAFT. VOLUME 2: SLOT NOZZLE CONFIGURATIONS Final Report, Jun. 1972 - Jul. 1975
B. H. Goethert, J. R. Maus, W. A. Dunnill et al Jul. 1975 342 p refs
(Contract DOT-FA72WA-3053)
(AD-A019646/9; FAA-RD-75-163-Vol-2) Avail: NTIS HC $4.50 CSCL 17B

Results obtained for two dimensional rectangular slot nozzles without and with straight attached flaps are presented. For vol. 1, see N76-24233. Author

N76-24235*# Pratt and Whitney Aircraft, East Hartford, Conn.
POLLUTION TECHNOLOGY PROGRAM, CAN-ANNULAR COMBUSTOR ENGINES
R. Roberts, A. J. Fiorentino, and W. Greene May 1976 131 p refs
(Contract NAS3-18548)
(NASA-CR-135027; PWA-5394) Avail: NTIS HC $6.00 CSCL 21E

A Pollution Reduction Technology Program to develop and demonstrate the combustor technology necessary to reduce exhaust emissions for aircraft engines using can-annular combustors is described. The program consisted of design, fabrication, experimental rig testing and assessment of results and was conducted in three program elements. The combustor configurations of each program element represented increasing potential for meeting the 1979 Environmental Protection Agency (EPA) emission standards, while also representing increasing complexity and difficulty of development and adaptation to an operational engine. Experimental test rig results indicate that significant reductions were made to the emission levels of the baseline JT8D-17 combustor by concepts in all three program elements. One of the Element I single-stage combustors reduced carbon monoxide to a level near, and total unburned hydrocarbons (THC) and smoke to levels below the 1979 EPA standards with little or no improvement in oxides of nitrogen. The Element II two-stage advanced Vorbix (vortex burning and mixing) concept met the standard for THC and achieved significant reductions in CO and NOx relative to the baseline. Although the Element III prevaporized-premixed concept reduced high power NOx below the Element II results, there was no improvement to the integrated EPA parameter relative to the Vorbix combustor. Author

N76-24236*# General Electric Co., Evendale, Ohio. Advanced Engineering and Technology Programs Dept.
SINGLE STAGE, LOW NOISE, ADVANCED TECHNOLOGY FAN. VOLUME 1: AERODYNAMIC DESIGN
T. J. Sullivan, J. L. Younghans, and D. R. Little Mar. 1976 145 p refs
(Contract NAS3-16813)
(NASA-CR-134801; R76AEG257-Vol-1) Avail: NTIS HC $6.00 CSCL 21E

The aerodynamic design for a half-scale fan vehicle, which would have application on an advanced transport aircraft, is described. The single stage advanced technology fan was designed to a pressure ratio of 1.8 at a tip speed of 503 m/sec 11,650 ft/sec). The fan and booster components are designed in a scale model flow size convenient for testing with existing facility and vehicle hardware. The design corrected flow per unit annulus area at the fan face is 215 kg/sec sq m (44.0 lb m/sec sq ft) with a hub-tip ratio of 0.38 at the leading edge of the fan rotor. This results in an inlet corrected airflow of 117.9 kg/sec (259.9 lb m/sec) for the selected rotor tip diameter if 90.37 cm (35.58 in.). The variable geometry inlet is designed utilizing a combination of high throat Mach number and acoustic treatment in the inlet diffuser for noise suppression (hybrid inlet). A variable fan exhaust nozzle was assumed in conjunction with the variable inlet throat area to limit the required area change of the inlet throat at approach and hence limit the overall diffusion and inlet length. The fan exit duct design was primarily influenced by acoustic requirements, including length of suppressor wall treatment; length, thickness and position on a duct splitter for additional suppressor treatment; and duct surface Mach numbers. Author

N76-24237*# General Electric Co., Evendale, Ohio. Advanced Engineering and Technology Programs Dept.
SINGLE STAGE, LOW NOISE, ADVANCED TECHNOLOGY FAN. VOLUME 2: STRUCTURAL DESIGN
J. L. Schoener, G. R. Black, and R. H. Roth Mar. 1976 50 p refs
(Contract NAS3-16813)
(NASA-CR-134802; R76AEG258-Vol-2) Avail: NTIS HC $4.00 CSCL 21E

The structural design for a half-scale fan vehicle, which would have application on an advanced transport aircraft, is described. The single stage advanced technology fan was designed to a pressure ratio of 1.8 at a tip speed of 503 m/sec (1,650 ft/sec). This mechanical design report describes the fan rotor design and the design of various structures of the vehicle; eg, stators, casings, splitters, seals, adapters, etc. Author

N76-24238*# General Electric Co., Evendale, Ohio. Advanced Engineering and Technology Programs Dept.
SINGLE STAGE, LOW NOISE ADVANCED TECHNOLOGY FAN. VOLUME 3: ACOUSTIC DESIGN
S. B. Kazin and R. B. Mishler Mar. 1976 56 p refs
(Contract NAS3-16813)
(NASA-CR-134803; R76AEG259-Vol-3) Avail: NTIS HC $4.50 CSCL 21E

The acoustic design for a half-scale fan vehicle, which would have application on an advanced transport aircraft, is described. The single stage advanced technology fan was designed to a pressure ratio of 1.8 at a tip speed of 503 m/sec (1,650 ft/sec). The two basic approaches taken in the acoustic design were:

(1) minimization of noise at the source, and (2) suppression of the generated noise in the inlet and bypass exhaust duct. Suppression of the generated noise is accomplished in the inlet through use of the hybrid concept (wall acoustic treatment plus airflow acceleration suppression) and in the exhaust duct with extensive acoustic treatment including a splitter. The goal of the design was attainment of twenty effective perceived noise decibels (20 EPNdB) below current Federal Air Regulation noise standards for a full-scale fan at the takeoff, cutback, and approach conditions. Predicted unsuppressed and suppressed fore and aft maximum perceived noise levels indicate that the cutback condition is the most critical with respect to the goal, which is probably unattainable for that condition. This is also true for aft radiated noise in the approach condition. Author

N76-24239# Boeing Co., Wichita, Kans.
FAA JT3D QUIET NACELLE RETROFIT FEASIBILITY PROGRAM. VOLUME 2, ADDENDUM A: MODEL AND FULL SCALE PLUG NOZZLE TESTS Final Report, Jul. 1974 - Mar. 1975
J. E. Mayer, L. L. Linscheid, and H. F. Veldman Apr. 1975 220 p refs
(Contract DOT-FA71WA-2628)
(AD-A023037/5; FAA-RD-73-131-Vol-2-Add-A; D3-9042-6) Avail: NTIS HC $7.75 CSCL 20/1

Previous tests of plug nozzles resulted in conflicting evidence of acoustic suppression. Model scale plug nozzles provided significant jet noise suppression; limited or no noise suppression was observed during tests of full scale plug nozzles. The tests reported in this addendum were performed to identify the reason for noncorrelation between model and full scale acoustic results. Four one-sixth scale primary exhaust steam plug nozzle configurations were tested to determine acoustic performance. A one-sixth scale conical nozzle was tested to provide an acoustic baseline. The model scale revised Phase 2 plug provided acoustic suppression. The model scale revised Phase 2 plug with a long conical afterbody provided additional suppression. The revised Phase 2 plug and the plug with long conical afterbody were tested full scale on a 707/JT3D quiet nacelle. Only slight suppression was observed with the revised Phase 2 plug; no additional suppression was observed with the long conical afterbody configuration. Analyses were performed to identify the reason for noncorrelation between model and full scale acoustic results. It was found that the acoustic performance of the model scale plug nozzle was essentially independent of the fan stream; whereas, full scale acoustic levels with fan flow were consistently higher than without fan flow. A geometric comparison of model and full scale revealed that the primary exhaust stream of the model simulated full scale. The fan stream of the model included an idealization which did not exactly replicate the full scale fan duct. It is believed that the geometric configuration of the full scale fan duct provided an additional noise source which was not present in the scale model and that this additional noise effectively masked the suppression provided by the full scale plug nozzle. Author

N76-24240*# General Dynamics/Fort Worth, Tex.
INLET SPILLAGE DRAG TESTS AND NUMERICAL FLOW-FIELD ANALYSIS AT SUBSONIC AND TRANSONIC SPEEDS OF A 1/8-SCALE, TWO-DIMENSIONAL, EXTERNAL-COMPRESSION, VARIABLE-GEOMETRY, SUPERSONIC INLET CONFIGURATION
J. E. Hawkins, F. P. Kirkland, and R. L. Turner Washington NASA Apr. 1976 107 p refs
(Contract NAS2-7210)
(NASA-CR-2680) Avail: NTIS HC $5.50 CSCL 21E

Accurate spillage drag and pressure data are presented for a realistic supersonic inlet configuration. Results are compared with predictions from a finite-differencing, inviscid analysis computer procedure. The analytical technique shows good promise for the evaluation of inlet drag, but necessary refinements were identified. A detailed description of the analytical procedure is contained in the Appendix. Author

N76-24241*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THRUST PERFORMANCE OF ISOLATED, TWO-DIMENSIONAL SUPPRESSED PLUG NOZZLES WITH AND WITHOUT EJECTORS AT MACH NUMBERS FROM 0 TO 0.45
Douglas E. Harrington, James J. Schloemer (GE Co., Cincinnati), and Stanley A. Skebe Washington May 1976 36 p refs
(NASA-TM-X-3384; E-8556) Avail: NTIS HC $4.00 CSCL 21E

A series of two-dimensional plug nozzles was tested with and without ejector shrouds at free stream Mach numbers from 0 to 0.45 and over a range of nozzle pressure ratios from 2 to 4. These nozzles were also tested with and without chute noise suppressors. A two-dimensional plug nozzle has an efficiency of 96.1 percent at an assumed takeoff pressure ratio of 3.0 and Mach 0.36. A 12-chute suppressed nozzle with sidewalls has an efficiency of 81.0 percent (15.1 percent below the unsuppressed nozzle). Author

N76-24242*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SMALL, LOW-COST, EXPENDABLE TURBOJET ENGINE. 1: DESIGN, FABRICATION, AND PRELIMINARY TESTING
Robert P. Dengler and Lawrence E. Macioce Washington May 1976 51 p refs
(NASA-TM-X-3392; E-8590) Avail: NTIS HC $4.50 CSCL 21E

A small experimental axial-flow turbojet engine in the 2,669-Newton (600-lbf) thrust class was designed, fabricated, and tested to demonstrate the feasibility of several low-cost concepts. Design simplicity was stressed in order to reduce the number of components and machining operations. Four engines were built and tested for a total of 157 hours. Engine testing was conducted at both sea-level static and simulated flight conditions for engine speeds as high as 38,000 rpm and turbine-inlet temperatures as high as 1,255 K (1,800 F). Author

N76-24243# European Space Agency, Paris (France).
ENGINE NOISE
Feb. 1976 276 p refs Transl. into ENGLISH of 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 294 p Proc. of DGLR Tech. Comm. for Airbreathing Propulsion Systems Symp., Brunswick, 20-21 Feb. 1974 Original German report available from ZLDI, Munich DM 57.75
(ESA-TT-244; DLR-Mitt-74-21) Avail: NTIS HC $9.25

Several aspects of aircraft noise are considered. They include jet noise, human reactions to aircraft noise in general, noise regulations, turbofan engine noise, compressor noise, wing and tail screening effects on engine noise, and propeller aircraft noise. For individual titles, see N76-24244 through N76-24256.

N76-24244 European Space Agency, Paris (France).
OPTIMISED ENGINES FOR QSTOL APPLICATIONS
Joachim Kurzke *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 9-34 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 9-34 (For availability see N76-24243 15-07)

The requirements of QSTOL propulsion are discussed. A typical example of a quiet two-shaft bypass engine with variable nozzle in the bypass duct was selected. The calculation of fan and jet noise is discussed. A performance calculation of the take-off and flight condition as well as assumptions for the determination of the engine size and the component efficiency are briefly described. The selected engine is optimized taking eight free variables into account and using a special method. Starting points for the systematic optimization according to a steepest gradient method are derived, based on the Monte Carlo method. An example of an optimization calculation and the results obtained are described. Author (ESA)

N76-24245 European Space Agency, Paris (France).
AIRCRAFT NOISE IN RESIDENTIAL AREAS: MEASUREMENT AND ANALYSIS **c53**
Hans Otto Finke, R. Martin et al *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 35-47 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 35-42 (For availability see N76-24243 15-07)

An interdisciplinary investigation was carried out on the effects of aircraft noise on man in the vicinity of airports. The sociological, psychological, and physiological effects, and the conditions under

which they occur, were investigated. The manner in which the ambient environment on the psychical or somatic properties of individuals affect their reactions to aircraft noise were determined. The interrelationship of acoustic noise load parameters and the reactions of those affected was studied. The program was carried out in the proximity of a major airport and covered the following activities: sociological interviews, psychological and psycho-physiological experiments, medical anamnesis, and flight noise measurements. ESA

N76-24246 European Space Agency, Paris (France).
NOTES ON NOISE INDEX NUMBERS (TAKING INTO ACCOUNT THE RESULTS OF THE MUNICH AIRCRAFT NOISE INVESTIGATION CARRIED OUT BY THE GERMAN RESEARCH ASSOCIATION) c53
Klaus Matschat, E. A. Mueller, G. Zimmermann et al *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 48-52 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 43-47 (For availability see N76-24243 15-07)

The problem of characterizing the average annoyance effect of a long period noise event (lasting hours or days), as described by the noise level time history (L(t)), by a single number, is discussed. Such a number is defined as the noise index. As a rule the formulas from which the noise index is calculated, based on L(t), are derived from laboratory and field investigations in which a prescribed noise situation and the reaction shown by a group of test subjects are recorded simultaneously. Proposals of extended noise indices were made, accounting for the effect of noise level fluctuation. An equation for an index of this kind was derived. ESA

N76-24247 European Space Agency, Paris (France).
AIRCRAFT NOISE LIMITS c84
Friedrich Karl Franzmeyer *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 54-68 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 49-65 (For availability see N76-24243 15-07)

The effect of noise limit regulations upon the technical design of civil aircraft is discussed. The noise limits were laid down as a function of weight, because it was considered that a higher flying weight requires higher powered engines generating a higher noise level. ESA

N76-24248 European Space Agency, Paris (France).
ON THE CALCULATION OF FAN NOISE
Klaus Heinig *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 70-92 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 67-87 (For availability see N76-24243 15-07)

For high bypass ratio aircraft turbines, the noise generated by the unsteady aerodynamic forces and the propagation of the noise inside and outside the fan can be calculated by means of the heterogeneous wave equation. When determining the noise from engine fans whose cross section dimensions are greater than the wave length of the generated noise, the effect of the fan duct on the noise generation can be neglected. Contrary to the calculation of the sound generation of the aerodynamic forces, the calculation of unsteady aerodynamic forces is still in its infancy. In spite of the factors neglected in the determination of the unsteady aerodynamic forces, the measured and calculated fan noise levels agree well even at this stage. Author (ESA)

N76-24249 European Space Agency, Paris (France).
SOME TECHNICAL PROBLEMS OF QUIET AIRCRAFT TECHNOLOGY
Wolfgang Dittrich *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 94-121 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 89-117 (For availability see N76-24243 15-07)

Three problems peculiar to quiet aircraft technology were studied. A vertical take-off procedure which could lead to extremely low noise reverberation on the ground is presented. The relationships for the vortex noise from fans with subsonic air intake velocities were derived. Bypass fans with subsonic tip speeds were studied so that the vortex contribution investigated gains in importance. The application of atmospheric ion engines as quiet aero-engines is discussed. Author (ESA)

N76-24250 European Space Agency, Paris (France).
ON THE REDUCTION OF COMPRESSOR NOISE BY MEANS OF HELICAL DETUNERS
Dieter Lohmann *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 123-137 Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 119-132 (For availability see N76-24243 15-07)

Tests were carried out on engine intake detuners whose configuration takes particular account of the qualitative properties of the compressor noise field. The helical detuners generate a vortex flow in the intake duct which exerts a favorable effect on acoustic cutoff. The solution of the wave equation yields damping and displacement of the natural frequencies as a function of the geometry of the detuners, which it was possible to verify by means of noise field measurements in model ducts. Other acoustic measurements in ducts with a flow passing through them show that the level of the noise field also decreases as a result of the flow. Author (ESA)

N76-24251 European Space Agency, Paris (France).
POSSIBILITIES OF NOISE REDUCTION FOR FAN ENGINES BY MEANS OF CONTROLS
Heinrich Dissen *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 138-148 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 133-144 (For availability see N76-24243 15-07)

A significant reduction of fan noise or jet noise can be achieved by varying the area of the primary and secondary propelling nozzles with constant engine thrust. For the engine with low bypass ratio, the fan noise reduction was calculated as being 4 dB max. and the jet noise reduction as approximately 5 dB max. As the bypass ratio increases, the fan noise reduction decreases while the jet noise reduction increases. It is not possible to reduce both noise components simultaneously by means of coupling the controls. The variation of the primary propelling nozzle has a significant effect on the generation noise; as the bypass ratio increases, variation of the secondary propelling nozzle becomes less effective in reducing noise. Author (ESA)

N76-24252 European Space Agency, Paris (France).
AIRCRAFT NOISE REDUCTION BY MEANS OF ACOUSTIC SCREENING AND ENGINE CONTROLS
Bernt-Hagen Gruenewald *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 149-178 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 145-172 (For availability see N76-24243 15-07)

With the arrangement of an engine above the wing it is possible to achieve sound screening for specific angles of radiation in relation to the ground. A calculation method for the determination of the ground noise level is described taking into account the screening effect of the wing. Calculations using the VFW 614 as an example show that the screening effect of the wing produces a reduction of the flyover noise level during the landing phase of approximately 3 EPNdB at a flyover altitude of approximately 240 m. For fan engines having the same take-off and landing thrust (= 54 % of take-off thrust) but a different bypass ratio of 3, 6, or 10, the effect on the radiation of the noise was mathematically investigated for a variation of the primary propelling nozzle area, the secondary propelling nozzle area, the fan blade angle of incidence, and for water injection. In each case, only one of the four parameters was varied, and the resulting thrust variation was rendered ineffective by appropriate movements of the throttle lever. Author (ESA)

N76-24253 European Space Agency, Paris (France).
SYSTEMATIC INVESTIGATIONS IN THE FIELD OF ACOUSTIC SCREENING
Hans-Heinrich Hoelscher *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 179-205 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 173-199 (For availability see N76-24243 15-07)

A series of tests was carried out on the screening effects of wings and tail surfaces on aircraft engine noise. The object was to test the applicability of prediction methods from optics on a surface having only one diffraction edge, which would conform as far as possible to the optimized condition. The effect of an edge radius such as applies to aerodynamic surfaces, and that of a sound absorbent coating on the noise screen on the source

side, was also investigated; the applicability of results to real surfaces with two and three diffraction edges was established. Measurements were carried out at different distances from the surfaces on nonabsorbing and absorbent surfaces with one, two, and three straight diffraction edges and one radiused edge. ESA

N76-24254 European Space Agency, Paris (France).
INVESTIGATION INTO THE NOISE PROPAGATION BY PROPELLER AIRCRAFT IN GENERAL AVIATION
Eicke Schmidt *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 207-249 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 201-241 (For availability see N76-24243 15-07)

A brief survey is given of the sources of noise in propeller-driven aircraft, their engines and propellers, together with the various mechanisms of noise generation. The results obtained in carrying out noise certification tests are reported. This showed that 11 % of the aircraft on which tests were requested did not satisfy the requirements. The values obtained during noise measurements on propeller-driven aircraft are shown as functions of several parameters, i.e. of blade tip Mach number and blade loading. The use of narrow band analyzers provides a means of estimating the engine and propeller noise components on specific aircraft and the spectral changes in the noise during flyover and at the time of the peak noise during the flyover. Author (ESA)

N76-24255 European Space Agency, Paris (France).
QUIETER PROPELLERS FOR GENERAL AVIATION: PRESENT POSITION, FUTURE EXPECTATIONS
Reinhard Hoffmann, G. Muehlbauer et al *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 251-265 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 243-258 (For availability see N76-24243 15-07)

The reduction of propeller noise of small executive and business aircraft up to 5.7 t is dealt with. Blade tips are the main noise source due to their circumferential speed. Noise reduction measures include shortening of the propeller to its repair minimum, and careful radiusing and profiling of the tip. The design of a variable pitch propeller with wooden blades combined with glass fiber plastics and metal is described. Future developments indicate large and low speed propellers, necessitating engines with gearboxes. ESA

N76-24256 European Space Agency, Paris (France).
NOISE PHENOMENA WITH HELICOPTER ROTORS AND POSSIBILITIES OF NOISE REDUCTION
Volker Langenbucher *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 266-292 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 259-274 (For availability see N76-24243 15-07)

Possibilities of reducing helicopter rotor noise are discussed. Rotational noise is mainly determined by area loading, while rotor noise is determined by blade loading. The effects of area loading and circumferential speed, blade loading, and aerodynamic shape of the blade on noise generation were investigated, and requirements were developed for the rotor configuration. Experimental investigations of noise reduction of tail rotors are reported. ESA

N76-24257# Scientific Translation Service, Ann Arbor, Mich.
EFFECT OF BLADE ASPECT RATIO ON THE PROPERTIES OF AN AXIAL COMPRESSOR STAGE
A. D. Gegin [1975] 28 p refs Transl. into ENGLISH from Prom. Aerod. (USSR), v. 29, 1973 p 35-55
(K-Trans-77) Avail: NTIS HC $4.50

An experimental and theoretical study of the performance of axial compressors with rotor blades having different aspect ratios shows an appreciable increase of the pressure coefficient and a decrease of stage efficiency when the aspect ratios of 1.13 or 0.55 are reached at relative hub diameters of 0.6 and 0.803, respectively, in axial compressor stage designs. The efficiency of blade rings with different blade aspect ratios was estimated. The structure of pressure losses in low aspect ratio blade rings was analyzed and the losses were calculated. A method is proposed for calculation of pressure losses. Design recommendations are given for the enhancement of axial compressor efficiency. Author (ERA)

N76-24258# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Zentralabteilung Luftfahrttechnik.
CHARACTERISTIC JET ENGINE PARAMETERS FOR PROJECT COMPARISONS [CHARAKTERISTISCHE STRAHLTRIEBWERKSPARAMETER FUER PROJEKTVERGLEICHE]
A. Lickleder Dec. 1974 36 p In GERMAN
(DLR-IB-555-74/13) Avail: NTIS HC $4.00

Characteristic parameters for 98 jet engines are depicted in graphs and listed in tables. The main parameters considered are thrust, weight, specific fuel consumption, air mass flow rate, compression, pressure, ratio, diameter, and length. ESA

N76-24259# United Technologies Corp., Windsor Locks, Conn.
MULTIPLE FAULT GAS PATH ANALYSIS APPLIED TO A TWIN SPOOL, MIXED FLOW, VARIABLE GEOMETRY, TURBOFAN ENGINE Final Report
Joseph M. Kos Oct. 1975 108 p
(Contract N00140-75-C-0449)
(AD-A019183; HSER-6794) Avail: NTIS CSCL 21/5

This report presents the results of a study made to develop a multiple fault diagnostic system for a complex twin spool, mixed flow, variable geometry turbofan engine using Hamilton Standard's Gas Path Analysis Technique. Engine data from a detailed nonlinear simulation of a paper engine was used. A simple control mode is also presented. Using a weighted least squared estimation procedure, a number of possible diagnostic routines are developed taking into account sensor and control uncertainties. A figure of merit is defined and used to isolate the acceptable diagnostic systems. GRA

N76-24260# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
DEVELOPMENT OF EMISSIONS MEASUREMENT TECHNIQUES FOR AFTERBURNING TURBINE ENGINES Final Technical Report, 1 Apr. 1973 - 31 Mar. 1975
T. F. Lyon, W. C. Colley, M. J. Kenworthy, and D. W. Bahr Oct. 1975 348 p refs
(Contract F33615-73-C-2047; AF Proj. 1900)
(AD-A019094; R75AEG457; AFAPL-TR-75-52) Avail: NTIS CSCL 21/2

Detailed emissions measurements were made throughout the plumes of J85-5 and J79-15 engines at military power and three afterburning power levels. Calculations of integrated pollutant flow rates at various axial stations showed that hydrocarbons are most reactive in the plume, with significant decreases observed at all afterburning power levels. Carbon monoxide can either increase or decrease with axial distance in the plume, depending on the power level and the hydrocarbon contents. No significant change in total oxides of nitrogen was observed at any power level. A computerized analytical plume model was developed and verified, which considers the simultaneous mixing and chemical reaction processes that can occur in the plumes of afterburning engines. The model enables calculating local concentrations of the various exhaust gases at any axial or radial location from initial values measured at the exhaust plane. A procedure for afterburning engine emissions measurements was developed. GRA

N76-24261# ARO, Inc., Arnold Air Force Station, Tenn.
CHRONOLOGY AND ANALYSIS OF THE DEVELOPMENT OF ALTITUDE PERFORMANCE AND MECHANICAL CHARACTERISTICS OF A TURBOFAN ENGINE AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER Final Report, 15 Aug. 1973 - 31 Mar. 1975
Jack T. Tate and T. J. Gillard AEDC Dec. 1975 30 p refs
(ARO Proj. B434.08A)
(AD-A018691; ARO-ETF-TR-75-70; AEDC-TR-75-119) Avail: NTIS CSCL 21/5

The chronology and analysis of the altitude development cycle of a typical current state-of-the-art turbine engine at the Engine Test Facility of the Arnold Engineering Development Center is reviewed to provide visibility and guidelines to improve the ETF/AEDC support capability to turbine engine test programs. A critical review of the program is reported with respect to three salient areas: (1) a comparison of the original test schedule with the achieved schedule, (2) a chronology of the engine builds

tested, (3) and a resume of the test planning/coordination activities of the program. GRA

N76-24262# Pratt and Whitney Aircraft, East Hartford, Conn.
APPLIED HIGH TEMPERATURE TECHNOLOGY PROGRAM, VOLUME 1 Final Technical Report, 1 Jun. 1971 - 31 Jan. 1975
Charles W. Hayes and J. J. Jackson Oct. 1975 269 p refs
(Contract F33657-71-C-0789; AF Proj. 668A)
(AD-A018637; PWA-5232-Vol-1; AFAPL-TR-75-44-Vol-1)
Avail: NTIS CSCL 21/5

The initial effort consisted of the development of aircooled columbium and thoria dispersed (TD) cobalt vanes for installation in an advanced development engine. The redirected effort, covered in the report, continued this development by further characterizing the poor fatigue behavior of the coated SU-31 columbium alloy and substituting a directionally solidified eutectic alloy for the TD cobalt material. The gamma/gamma:+delta D.S. eutectic alloy was chosen for this program. A technology base for design of gamma/gamma:+delta D.S. eutectic hardware is presented. This includes: casting, coating, joining, hole drilling, and material property evaluation. Material laboratory tests are described and data presented. Applications to aircooled turbine hardware is discussed. GRA

N76-24263# Pratt and Whitney Aircraft, East Hartford, Conn.
APPLIED HIGH TEMPERATURE TECHNOLOGY PROGRAM. VOLUME 2: EVALUATION OF COATED COLUMBIAN ALLOYS FOR ADVANCED TURBINE AIRFOILS Final Technical Report, 1 Jun. 1971 - 31 Jan. 1975
Charles W. Hayes and J. J. Jackson Oct. 1975 171 p
(Contract F33657-71-C-0789; AF Proj. 668A)
(AD-A018638; PWA-5232-Vol-2; AFAPL-TR-75-44-Vol-2)
Avail: NTIS CSCL 21/5

This report covers the columbium alloy evaluation. The objective of these evaluations was to determine the applicability of coated columbium alloys for advanced gas turbine vanes. The alloy SU-31 (Cb-17W-3.5 Hf-0.1C) was selected for evaluation following screening of wrought and cast alloys using the criteria of creep resistance at 2400F and fabricability. Hi Temp Co. R512E (Si-20Cr-20Fe) silicide coating was selected for this program. Mechanical and physical properties were determined and oxidation resistance was evaluated. Cast and wrought SU-31 vanes were fabricated and tested under simulated engine conditions. Based on the results of these evaluations, it was concluded that relatively poor cyclic oxidation and thermal fatigue properties are likely to prevent extended use of R512E coated SU-31. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-24264*# Analytic Sciences Corp., Reading, Mass.
USERS MANUAL FOR FLIGHT CONTROL DESIGN PROGRAMS
James Y. Nalbandian 24 Sep. 1975 103 p refs
(Contract NAS1-13807)
(NASA-CR-144913; TR-640-2) Avail: NTIS HC $5.50 CSCL 01C

Computer programs for the design of analog and digital flight control systems are documented. The program DIGADAPT uses linear-quadratic-gaussian synthesis algorithms in the design of command response controllers and state estimators, and it applies covariance propagation analysis to the selection of sampling intervals for digital systems. Program SCHED executes correlation and regression analyses for the development of gain and trim schedules to be used in open-loop explicit-adaptive control laws. A linear-time-varying simulation of aircraft motions is provided by the program TVHIS, which includes guidance and control logic, as well as models for control actuator dynamics. The programs are coded in FORTRAN and are compiled and executed on both IBM and CDC computers. Author

N76-24265*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A TECHNIQUE USING A NONLINEAR HELICOPTER MODEL FOR DETERMINING TRIMS AND DERIVATIVES
Aaron J. Ostroff, David R. Downing, and William J. Rood (Vought Corp., Hampton, Va.) Washington May 1976 96 p refs
(NASA-TN-D-8159; L-10555) Avail: NTIS HC $5.00 CSCL 01C

A technique is described for determining the trims and quasi-static derivatives of a flight vehicle for use in a linear perturbation model; both the coupled and uncoupled forms of the linear perturbation model are included. Since this technique requires a nonlinear vehicle model, detailed equations with constants and nonlinear functions for the CH-47B tandem rotor helicopter are presented. Tables of trims and derivatives are included for airspeeds between -40 and 160 knots and rates of descent between + or - 10.16 m/sec (+ or - 200 ft/min). As a verification, the calculated and referenced values of comparable trims, derivatives, and linear model poles are shown to have acceptable agreement. Author

N76-24266*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMULATOR STUDY OF THE EFFECTIVENESS OF AN AUTOMATIC CONTROL SYSTEM DESIGNED TO IMPROVE THE HIGH-ANGLE-OF-ATTACK CHARACTERISTICS OF A FIGHTER AIRPLANE
William P. Gilbert, Luat T. Nguyen, and Roger W. VanGunst Washington May 1976 156 p refs
(NASA-TN-D-8176; L-10545) Avail: NTIS HC $6.75 CSCL 01C

A piloted, fixed-base simulation was conducted to study the effectiveness of some automatic control system features designed to improve the stability and control characteristics of fighter airplanes at high angles of attack. These features include an angle-of-attack limiter, a normal-acceleration limiter, an aileron-rudder interconnect, and a stability-axis yaw damper. The study was based on a current lightweight fighter prototype. The aerodynamic data used in the simulation were measured on a 0.15-scale model at low Reynolds number and low subsonic Mach number. The simulation was conducted on the Langley differential maneuvering simulator, and the evaluation involved representative combat maneuvering. Results of the investigation show the fully augmented airplane to be quite stable and maneuverable throughout the operational angle-of-attack range. The angle-of-attack/normal-acceleration limiting feature of the pitch control system is found to be a necessity to avoid angle-of-attack excursions at high angles of attack. The aileron-rudder interconnect system is shown to be very effective in making the airplane departure resistant while the stability-axis yaw damper provided improved high-angle-of-attack roll performance with a minimum of sideslip excursions. Author

N76-24267# European Space Agency, Paris (France).
DIGITAL CONTROL
Dec. 1975 139 p refs Transl. into ENGLISH of 'Digitale Regelung u. Steuerung', DGLR, Cologne Report DLR-Mitt-73-17, 1973 139 p Papers presented at DGLR Tech. Comm. for Flight Control Meeting, Bremen, 27 Apr. 1972 and Ueberlingen, West Ger., 25 Oct. 1972 Original German report available from ZLDI, Munich DM 29.20
(ESA-TT-230; DLR-Mitt-73-17) Avail: NTIS HC $6.00

The problems of reliability and theoretical system design of digital CTOL and V/STOL control systems were discussed. The synthesis and analysis procedures of control algorithms and the selection of cost functions and evaluation factors were in the foreground of these discussions. A characteristic feature of the control laws discussed was the fact that they were derived in the majority of cases from analog control laws. Problems concerning the realization of digital control systems were also discussed, with particular regard to the structure and technical design of the equipment. The spectrum of the application range reaches from the digital control of conventional aircraft and helicopters to missile control. For individual titles, see N76-24268 through N76-24274.

N76-24268 European Space Agency, Paris (France).
IMPROVING RELIABILITY BY DIGITAL SIGNAL PROCESSING

Hans-Peter Joenck *In its* Digital Control (ESA-TT-230) Dec. 1975 p 7-19 Transl. into ENGLISH of 'Digitale Regelung u. Steuerung', DGLR, Cologne Report DLR-Mitt-73-17, 1973 p 7-19 (For availability see N76-24267 15-08)

The possible logic circuitry for increasing reliability in signal transmission is illustrated for a digital electro-hydraulic aircraft primary control system. Signal structure, redundancy procedures, and the construction of a logic unit whereby a failure is automatically recognized in the component itself, are discussed.

Author (ESA)

N76-24269 European Space Agency, Paris (France).

DIGITAL CONTROL FOR A FLIGHT-CONTROL TEST CARRIER

Wolfgang Kubbat *In its* Digital Control (ESA-TT-230) Dec. 1975 p 21-38 Transl. into ENGLISH of 'Digitale Regelung u. Steuerung', DGLR, Cologne Report DLR-Mitt-73-17, 1973 p 21-38 (For availability see N76-24267 15-08)

The design and simulation of digital control systems based on the dynamic programming (Bellmann) method and on a new method in which the performance criterion is exponentially weighted is reported. The controlled system is the BO-105 helicopter. Various examples are given showing that if the set of design methods is carefully used, uniformly good behavior over the entire range of flying conditions can be obtained in spite of great variations in the controlled system owing to different control systems. It is noteworthy that when the exponential time-weighted performance criterion is used, a constant digital control system with good properties can be designed.

Author (ESA)

N76-24270 European Space Agency, Paris (France).

CONSTRUCTION AND FLIGHT TESTING OF A DIGITAL AUTOPILOT SYSTEM

Robert Karl Zach, U. Hartmann et al *In its* Digital Control (ESA-TT-230) Dec. 1975 p 39-72 refs Transl. into ENGLISH of 'Digitale Regelung u. Steuerung', DGLR, Cologne Report DLR-Mitt-73-17, 1973 p 39-72 (For availability see N76-24267 15-08)

The digital control functions carried out by the BGT - DAS 21 digital flight control system were worked out and tested in numerous hybrid simulations and by flight tests on an operational model of a digital flight control system (DAS 10) in a DO 28 D Skyservant. The digital flight control functions include the following modes of operation: pre-flight testing, rolling and pitching position control, yawing control, height and course maintenance, and input of turn and pitch instructions. Continuous, simultaneous in-flight testing and automatic monitoring ensure that the control system, which has a simplex construction, is fail safe. Good transient behavior for all modes of operation was obtained at a uniform scanning frequency of 50 Hz in both the flight test and in realistic partial simulation over the entire speed range of the test aircraft.

Author (ESA)

N76-24271 European Space Agency, Paris (France).

A DIGITAL CONTROL PROCEDURE FOR STABILIZING A VTOL AIRCRAFT

Hans Juergen Berger *In its* Digital Control (ESA-TT-230) Dec. 1975 p 73-92 Transl. into ENGLISH of 'Digitale Regelung u. Steuerung', DGLR, Cologne Report DLR-Mitt-73-17, 1973 p 73-92 (For availability see N76-24267 15-08)

A control vector, in relation to the initial state and a desired final value, was calculated so as to convert a linear controlled system into the preset state in a given number of scanning steps, based on the vectorial difference equation for the controlled system. Nonlinear transient behavior can be obtained independently of the guide command. The resulting guide computer can be developed into a digital controller by additional simulation of the controlled system. The digital controller is used primarily for stabilizing the pitching angle of a hovering aircraft; it is also used in transition and in aerodynamic flight. When the method is applied to transition and aerodynamic flight, it is necessary to introduce an additional nonlinear algorithm, owing to the large changes in the parameters of the controlled system.

Author (ESA)

N76-24272 European Space Agency, Paris (France).

DIGITAL CONTROL SYSTEMS CONSTRUCTED AT THE VEREINIGTE FLUGTECHNISCHE ELECTRONICS LABORATORY

Juergen Fryen *In its* Digital Control (ESA-TT-230) Dec. 1975 p 93-100 Transl. into ENGLISH of 'Digitale Regelung u. Steuerung', DGLR, Cologne Report DLR-Mitt-73-17, 1973 p 93-100 (For availability see N76-24267 15-08)

A number of digital controllers for aircraft and missiles were constructed, analyzed in real-part and real-time simulation tests, and, in some cases, tested in practice. The Digital Autopilot Computer System (DARS) was developed for digital control of missiles. DARS is a flexible digital special computer system comprising individual basic building blocks which can be combined and enlarged, largely at will. The enlarged DARS components were used to construct a digital controller which was designed as an operating model for stabilizing a VTOL aircraft in hovering flight. During real partial simulation tests, the controller was used to demonstrate the practicability of the nonlinear control method using digital technology.

Author (ESA)

N76-24273 European Space Agency, Paris (France).

DESIGN OF EQUIPMENT FOR A DIGITAL CONTROL SYSTEM FOR A FLIGHT CONTROL TEST CARRIER

Wolfgang Kubbat *In its* Digital Control (ESA-TT-230) Dec. 1975 p 101-128 Transl. into ENGLISH of 'Digitale Regelung u. Steuerung', DGLR, Cologne Report DLR-Mitt-73-17, 1973 p 101-128 (For availability see N76-24267 15-08)

The problem of providing a test carrier (Bo 105) under development with an experimental digital controller is dealt with. The basic theory is summarized and the computer system and sensors used are described. Special attention is devoted to the operation of the onboard computer system and the preliminary development phase on the ground. The dialog between the pilot and computer via a special operating unit is illustrated and certain test and safety features of the single-channel experimental system are provided.

Author (ESA)

N76-24274 European Space Agency, Paris (France).

DESIGN AND STRUCTURE OF A UNIVERSAL DIGITAL IN-FLIGHT COMPUTER **c62**

Herbert Heins *In its* Digital Control (ESA-TT-230) Dec. 1975 p 129-139 Transl. into ENGLISH of 'Digitale Regelung u. Steuerung', DGLR, Cologne Report DLR-Mitt-73-17, 1973 p 129-139 (For availability see N76-24267 15-08)

The Siemens computer 404/31 was developed for use in aircraft, rockets, ships, and vehicles. Special importance was attached to the ability to withstand severe environmental conditions, and to low volume and weight, low power consumption, universal applicability, and high output. The development work has been completed and the first pre-production models have been supplied to users for test systems.

Author (ESA)

N76-24275# European Space Agency, Paris (France).

RELIABILITY OF DIGITAL ELECTRONIC FLY-BY-WIRE SYSTEMS

W. Metzdorff Feb. 1976 120 p refs Transl. into ENGLISH of 'Zuverlaessigkeit digitaler elektron. Flugzeug-Primaersteuersysteme', DFVLR, Brunswick Report DLR-FB-73-85, 1973 Original German report available from DFVLR, Porz, West Ger. DM 22.50

(ESA-TT-243; DLR-FB-73-85) Avail: NTIS HC $5.50

From the analysis of fly-by-wire reliability models it is shown how the required reliability can be obtained, within certain confidence limits and with acceptable testing costs, when in-flight repair is applied. The effectiveness of error detection and of failure detection in redundant systems is treated and compared with special emphasis on the physical signal structure. Technical solutions to the failure detection problem in digital systems are demonstrated.

Author (ESA)

N76-24276# European Space Agency, Paris (France).

THE DESIGN OF A PROPORTIONAL-INTEGRAL COMMAND AUGMENTATION CONTROL SYSTEM USING OPTIMAL STATE REGULATOR THEORY FOR THE STEEP LANDING APPROACH OF THE HFB 320 'HANSA' AIRCRAFT

Norbert Stuckenberg Dec. 1975 47 p refs Transl. into ENGLISH of 'Entwurf eines Vorgaberegelsystems mit proportional-integralem

Regler fuer den Steilanflug des Flugzeugs HFB 320 'Hansa' nach der Theorie des optimalen Zustandsreglers', DFVLR, Brunswick Report DLR-FB-75-19, 20 Jan. 1975 Original German report available from DFVLR, Porz, West Ger. DM 18.90
(ESA-TT-235; DLR-FB-75-19) Avail: NTIS HC $4.00

A two-stage design method based on the optimal state regulator theory is described for a command control system with proportional and integral feedback and with direct links between the command inputs and the controls. This method is applied to the design of a command augmentation control system for the steep landing approach of the HFB 320 'Hansa' business jet aircraft. The pilot inputs are glidepath angle and speed commands. Angle of attack is used as an indirect command input in order to keep the aircraft within its aerodynamic limitations as well as to make an effective use of the controls, which are elevator, flaps, and throttle. Author (ESA)

N76-24277# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
PERFORMANCE AND HANDLING QUALITIES: AH-1G HELICOPTER EQUIPPED WITH THREE HOT METAL/PLUME INFRARED SUPPRESSORS Final Report, 2 Sep. - 14 Nov. 1974
Albert L. Winn and Robert L. Stewart Apr. 1975 60 p refs
(AD-A019482; USAAEFA-75-01) Avail: NTIS CSCL 01/2

The performance and handling qualities of the AH-1G helicopter were quantitatively and qualitatively evaluated with a standard exhaust duct and with Garrett, Lycoming, and Bell infrared suppressors installed. Twenty-one flights were flown for a total of 20.7 productive flight hours. The effectiveness of the suppressors themselves in reducing infrared radiation was not a part of this test. GRA

N76-24278# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
RECOVERY TECHNIQUES FOR AIRCRAFT IN SPINNING FLIGHT M.S. Thesis
William A. Flanagan Dec. 1975 132 p refs
(AD-A019323; GAE/MC/75-3) Avail: NTIS CSCL 01/2

This study represents an attempt to use numerical solutions of the equations of motion to discover the most effective control surface deflections for use in a delta-winged fighter for recovery from a fully developed spin. The recovery methods were tested upon stable spins since the stable flat spin is generally the most dangerous spin. GRA

N76-24279# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
APPLICATION OF DESIGNS TO IMPROVE AIRCRAFT FLIGHT CONTROL SURVIVABILITY
Frederick R. Taylor and John Schonowski 5 Sep. 1975 44 p refs Presented at the Am. Defense Preparedness Assoc. Symp. on Vulnerability and Survivability, San Diego, Calif., 21-23 Oct. 1975 Prepared in cooperation with Navy
(AD-A018733) Avail: NTIS CSCL 01/3

This paper is presented in two parts. It summarizes the operational flight control survivability experience during the past decade and describes designs that have been implemented or developed to reduce the vulnerability of tactical aircraft flight control systems. Presented are the results of analyses and evaluations of combat experience data wherein flight controls contributed disproportionately to approximately twenty-five (25) percent of aircraft losses, while comprising only five (5) percent of total aircraft presented area. The culprit components, concepts and mechanizations have been identified, and suggested designs are presented to minimize aircraft flight control system vulnerability. Finally, the impacts that these designs can or have had on new weapon system developments are shown. Also indicated, is the extent, if any, survivability enhancement is incorporated into newly acquired or developmental aircraft such as the A-10, F-14, F-15, F-16, F-18, and AAH. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N76-24280* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VEHICLE SIMULATOR BINOCULAR MULTIPLANAR VISUAL DISPLAY SYSTEM Patent
Wendell D. Chase, inventor (to NASA) Issued 18 May 1976 32 p Filed 13 Sep. 1974 Supersedes N74-32718 (12 - 22, p 2672)
(NASA-Case-ARC-10808-1; US-Patent-3,956,833; US-Patent-Appl-SN-505881; US-Patent-Class-35-12N; US-Patent-Class-178-7.89; US-Patent-Class-178-DIG.35) Avail: US Patent Office CSCL 14B

An aircraft simulator is described for practice landing maneuvers. A cathode ray tube (CRT) produces an image corresponding to the runway which changes in response to the trainee's manipulation of controls. The CRT image is projected along an optical path to a screen that is visually accessible to the trainee. Interposed in the optical path are optical elements such as mirrors which are spaced from one another along the optical path so as to create virtual images on the screen that appear to be at different distances from the trainee. The optical elements are sequentially interposed in the path and circuits are provided for synchronizing the production of the CRT image with one of the optical elements so that the image on the screen appears to have a range corresponding to the environment being simulated. Official Gazette of the U.S. Patent Office

N76-24281 Ernst-Mach-Inst., Freiburg (West Germany).
EFFECT OF DIAPHRAGM DIAMETER ON THE PRESSURE-TIME HISTORY IN A SHOCK TUBE OF 70m LENGTH
H. P. Mehlin and M. Froboese May 1975 34 p refs In GERMAN; ENGLISH summary Prepared jointly with Inst. Franco-Allemand de Rech.
(Rept-2/75) Avail: Issuing Activity

For the operation of large blast simulators drivers are necessary, producing high peak pressure and long duration of overpressure. Possibly a bundle of air driven diaphragm shock tubes may be used as drivers. For this case the influence of the sectional area of the diaphragm was investigated. Experiments were conducted at different overpressures in the driver section of the tube between 40 and 150 bar and at a ratio of the sectional area (sectional area of the tube versus sectional area of the diaphragm) between 5 and 20. Pressure profiles were recorded by 14 gages divided over the length of the tube of 70 m. The pressure profiles near the diaphragm show a remarkable course marked by a deep long drawn saddle of the overpressure that cannot yet be explained. A quantitative analysis is shown diagrammatically and was partly collated with theoretical results of H. O. Amann. The calculated and experimental results are in quite good agreement. Author (ESA)

N76-24282*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
DEVELOPMENT AND APPLICATION OF AN ATMOSPHERIC TURBULENCE MODEL FOR USE IN FLIGHT SIMULATORS IN FLIGHT SIMULATORS
Ira D. Jacobson and Dinesh S. Joshi May 1976 92 p refs (Grant NGR-47-005-208)
(NASA-CR-147985; ESS-4035-105-76) Avail: NTIS HC $5.00 CSCL 14B

The influence of simulated turbulence on aircraft handling qualities was investigated. Pilot opinion of the handling qualities of a light general aviation aircraft were evaluated in a motion-base simulator using a simulated turbulence environment. A realistic representation of turbulence disturbances is described in terms of rms intensity and scale length and their random variations with time. The time histories generated by the proposed turbulence models showed characteristics which appear to be more similar to real turbulence than the frequently-used Gaussian

turbulence model. In addition, the proposed turbulence models can flexibly accommodate changes in atmospheric conditions and be easily implemented in flight simulator studies. Six turbulence time histories, including the conventional Gaussian model, were used in an IFR-tracking task. The realism of each of the turbulence models and the handling qualities of the simulated airplane were evaluated. Analysis of pilot opinions shows that at approximately the same rms intensities of turbulence, the handling quality ratings transit from the satisfactory level, for the simple Gaussian model, to an unacceptable level for more realistic and compositely structured turbulence models.
Author

N76-24283# Technische Hochschule, Aachen (West Germany). Stosswellenlab.
EXPERIMENTAL INVESTIGATIONS ON REENTRY BODIES AT HYPERSONIC SPEEDS. PART 2: DEVELOPMENT AND CONSTRUCTION OF SHOCK TUNNEL WITH EXPANDED PERFORMANCE Final Report [EXPERIMENTELLE UNTERSUCHUNGEN AN RAUMFLUGKOERPERN IM HYPERSCHALLBEREICH. TEIL 2: ENTWICKLUNG UND AUFBAU EINES STOSSWELLENKANALS MIT ERWEITERTEM LEISTUNGSBEREICH]
Hans Groenig and Heinz Schumacher Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-W-75-22) Avail: NTIS HC $4.00; ZLDI, Munich DM 7.60

The reflected mode shock tunnel is described in detail. Relatively high stagnation temperatures may be achieved. Since, on the other hand, the related shock tube is designed for pressures up to 2,000 atm, high pressures in the reflected zone may be obtained by a corresponding high pressure of 10 to 30 atm in the low pressure section leading to high Reynolds numbers in the expansion test section flow. Author (ESA)

N76-24284# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
REAL TIME MACH NUMBER CONTROL IN A TRANSONIC BLOWDOWN WIND TUNNEL Ph.D. Thesis - Paris Univ.
Jean-Louis Gobert 1975 67 p refs In FRENCH; ENGLISH summary Report will also be announced as translation
(ONERA-NT-1975-5) Avail: NTIS HC $4.50

An instrumentation for servo-controlling the Mach number in a transonic blow-down wind tunnel according to instructions given by the operator is described. Control is ensured numerically by means of a mini-computer working in real time. The study consisted in identifying the process to be controlled, i.e. in determining the wind tunnel behavior, then in looking for control laws to be applied by the servo-system. A rapid survey of classical aerodynamics with a view to explain the means of action on the Mach number as well as the measuring method used is made. The study for determining the characteristics of the control system is described. Results of simulations carried out on the IRIS 80 computer of ONERA, are given and it is shown how the system can be installed on the site. Author (ESA)

N76-24285# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INFLUENCE OF RUNWAY ROUGHNESS ON THE DYNAMIC BEHAVIOR OF AIRCRAFTS AT TAKEOFF Ph.D. Thesis - Besancon Univ., France
Jean-Paul Drevet 1975 78 p refs In FRENCH; ENGLISH summary Report will also be announced as translation
(ONERA-NT-1975-11) Avail: NTIS HC $5.00

Runway construction criteria are defined. The point is to reduce as much as possible the vertical accelerations in the aircraft cockpits during take-off. A mathematical model of the aircraft, taking account of undercarriage non-linearities, was developed and programmed on a hybrid computer. This made it possible to carry out a number of take-off simulations on actual or synthetic runways. Dangerous wavelengths were thus revealed, and the efficacy of hitherto retained criteria was analyzed. Lastly, improvements are proposed. Author (ESA)

N76-24286# Army Natick Development Center, Mass.
RELOCATABLE MAINTENANCE HANGAR CONCEPT EVALUATIONS
Arthur Johnson Jul. 1975 54 p refs
(DA Proj. 1T7-63726-D-669)
(AD-A019229; NDC-TR-76-14-AMEL) Avail: NTIS CSCL 01/5

The report was prepared to summarize the effort undertaken to evaluate concepts and determine a program for development of the Relocatable Maintenance Hangar. Five basic shelter concepts were considered, analyzed, and evaluated against desired characteristics. The information presented includes the basic structural characteristics and the associated technical barriers involved in the development of each concept. GRA

N76-24287# R and D Associates, Marina Del Rey, Calif.
A NEW DEVICE TO FACILITATE MOVING F-15 AIRCRAFT IN AND OUT OF AIRCRAFT SHELTERS
R. L. Helmbold Jul. 1975 32 p
(Contract F29601-75-C-0061)
(AD-A018854; RDA-TR-9400-001) Avail: NTIS CSCL 01/5

The new F-15A fighters barely fit through the entrance of a standard aircraft shelter, the most critical dimension being the vertical clearance over the F-15's tall vertical stabilizers. In this report we suggest that the passage of F-15's through the most constricted part of the entrance to a standard shelter could be considerably eased by locating a low hump-shaped riser approximately 36 feet long and 1 foot high just outside the entranceway. This riser would lift the nosewheel slightly above grade level as the aircraft rolled over it, and thereby lower the tail enough to provide adequate vertical clearance between the F-15's vertical stabilizers and the doorway to the shelter. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-24288*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
ARTIFICIAL SOLAR ECLIPSE EXPERIMENT DURING THE JOINT FLIGHT OF THE SOYUZ AND APOLLO SPACECRAFT
G. M. Nikolskiy Washington NASA May 1976 8 p Transl. into ENGLISH of 'Eksperiment iskusstvennoye solnechnoye zatmeniye pri sovmestnom polete kosmicheskikh korabley Soyuz i Apollon', Rept. Pr-232. Acad. of Sci. USSR, Inst. of Earth Magnetism, Ionosphere and Radiowave Propagation, Moscow, 1975 8 p
(Contract NASw-2789)
(NASA-TT-F-17051) Avail: NTIS HC $3.50 CSCL 22A

A short description is given of an artificial solar eclipse, performed for the first time in space during the joint flight of the Soviet and American spacecraft. Data are presented on observations of the solar eclipses and their role in the study of the upper layers of the solar atmosphere (the corona). The physical nature of the solar corona is briefly described. Author

N76-24289*# California Univ., Los Angeles. School of Engineering and Applied Science.
ZERO-GRAVITY GROWTH OF NaF-NaCl EUTECTICS IN THE NASA SKYLAB PROGRAM Final Report
A. S. Yue, F. G. Allen, and J. G. Yu Jan. 1976 67 p refs
(Contract NAS8-28310)
(NASA-CR-144311; UCLA-ENG-7609) Avail: NTIS HC $4.50 CSCL 11D

Continuous and discontinuous NaF fibers, embedded in a NaCl matrix, were produced in space and on earth. The production of continuous fibers in a eutectic mixture is attributed to the absence of convection current in the liquid during solidification in space. Image transmission and optical transmittance measurements of transverse sections of the space-grown and earth-grown ingots were made with a light microscope and a spectrometer. It is shown that better optical properties were obtained from samples grown in space. This was attributed to a better alignment of NaF fibers along the ingot axis. A new concept is advanced to explain the phenomenon of transmittance versus far infrared wavelength of the directionally solidified NaCl-NaF eutectic in terms of the two-dimensional Bragg Scattering and the polarization

effect of Rayleigh scattering. This concept can be applied to other eutectic systems as long as the index of refraction of the matrix over a range of wavelengths is known. Experimental data are in agreement with the theoretical prediction. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-24290*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
UNIVERSAL FURNACE EXPERIMENT SOYUZ-APOLLO EXPERIMENTAL FLIGHT
L. I. Ivanov and V. S. Zemskov Washington NASA May 1976 10 p Transl. into ENGLISH from the Russian report Pr-231
(Contract NASw-2789)
(NASA-TT-F-17050; Pr-231) Avail: NTIS HC $3.50 CSCL 22A

A description of the Universal Furnace series of experiments planned for the Apollo-Soyuz flight was given. The objective of these experiments is to investigate the weightlessness effect on the process of melting metals and alloys. The samples of metals and alloys under investigation, placed in evacuated quartz ampoules, are arranged using a system of graphite, metal and insulation packings in a cartridge container. Before the final sealing, air is evacuated from the cartridge, which is then filled with a small amount of inert gas. A graphite assembly with an electric heating coil wound on it is the main element of the furnace. The automatic control system provides for a selection and control of the temperature for heating the cartridge's hot end during the experiment, aging time and the active cooling process with a controlled speed. Author

N76-24291*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MATHEMATICAL THEORY OF THE GODDARD TRAJECTORY DETERMINATION SYSTEM
J. O. Cappellari, ed. (Computer Sci. Corp.), C. E. Velez, ed., and A. J. Fuchs, ed. Apr. 1976 529 p refs
(NASA-TM-X-71106; X-582-76-77) Avail: NTIS HC $13.00 CSCL 22A

Basic mathematical formulations depict coordinate and time systems, perturbation models, orbital estimation techniques, observation models, and numerical integration methods. For individual titles, see N76-24292 through N76-24302.

N76-24292* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GTDS OVERVIEW
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 19 p (For availability see N76-24291 15-13)
CSCL 22A

Orbit determination in the earth/lunar/interplanetary trajectory determination system involves a complex mathematical process which combines the disciplines of orbital dynamics, observation modeling, and estimation theory. This process is implemented through the use of several separate programs. Also included is a discussion of the early orbit determination process, which allows a crude initial estimate of the orbit to be obtained from early tracking data. In addition, the orbit determination system combines capabilities which are frequently useful in mission analysis studies when executed independently. Author

N76-24293* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COORDINATE AND TIME SYSTEMS
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 81 p refs (For availability see N76-24291 15-13)
CSCL 22A

The orbital determination process involves measurements that are taken and forces that are modeled in several different space and time coordinate systems. These systems are defined and the necessary transformations between them are illustrated. Author

N76-24294* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PERTURBATION MODELS AND VARIATIONAL EQUATIONS
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 88 p refs (For availability see N76-24291 15-13)
CSCL 22A

For orbital prediction using the method of special perturbations, the equations of motion of the satellite are integrated numerically. The perturbing acceleration vector is used to construct these equations. The sources of these perturbations are identified and the appropriate perturbation models are presented. The perturbations discussed include: The gravitational acceleration due to n-point masses; the gravitational acceleration due to nonsphericity of the gravitational potential; the acceleration due to the mutual nonspherical gravitational attraction of the earth and moon; the acceleration due to aerodynamic forces; the acceleration due to solar radiation pressure; the acceleration due to thrusting of the spacecraft engines; the acceleration due to attitude control system corrections; and model replacement accelerations. All or any subset of these effects can be included in the perturbing acceleration vector which is used in the construction of the equations of motion using either the Cowell or Variation of Parameters formulations. Author

N76-24295* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FORMULATION OF THE ORBITAL EQUATIONS OF MOTION
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 62 p refs (For availability see N76-24291 15-13)
CSCL 22A

Research on improving the accuracy and efficiency of orbit generation methods indicates that there is no best orbit generation procedure for all orbit types. For this reason, several orbit generation formulations are included in GTDS; taken together, these formulations are suited to a broad range of accuracy and efficiency requirements for the various classes of satellite's orbits. In general, development of optimum methods for orbit prediction consists of reformulating the equations of motion in terms of a new set of variables such that the resulting equations are more amenable to solution. The principal guidelines used in these reformulations are outlined. Author

N76-24296* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUMERICAL INTEGRATION OF THE EQUATIONS OF MOTION AND VARIATIONAL EQUATIONS
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 27 p refs (For availability see N76-24291 15-13)
CSCL 22A

The Stormer-Cowell/Adams integration processes available in GTDS for integration of the Cowell and various VOP formulations of the equations of motion are described. These processes were selected on the basis of efficiency studies comparing various classes of popular integration algorithms as applied to special perturbation techniques. Also reported is the single step Runge-Kutta integration method that is used in GTDS in connection with sequential estimation and as a starter for certain multistep processes. Author

N76-24297* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATION MODELS c17
In its Mathematical Theory of the Goddard Trajtectory Determination System Apr. 1976 81 p refs (For availability see N76-24291 15-13)
CSCL 22C

Spacecraft tracking observations involve the measurement of some physical property of electromagnetic wave propagation between the tracking station and the spacecraft. The process of analytically relating measurement quantities to the spacecraft state vector is referred to as observation modeling. These models consist of kinematic equations that yield the ideal values of the observations in trajectory related units. Procedures and formula-

tions that describe all data types implemented in GTDS modeling are described. Included are: satellite to satellite tracking, radar altimeter tracking, and very long baseline interferometer tracking, respectively. The interrelationship between observation models and the estimation process is summarized. Author

N76-24298* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ESTIMATION
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 65 p refs (For availability see N76-24291 15-13)
CSCL 22A

The basic orbit estimation problem involves solving for values of a set of parameters from an observational model so as to minimize, in the sense of weighted least squares, the differences between a computed and an observed trajectory. The model parameters include the trajectory of the vehicle, the locations of the observing stations, and the bias errors in their instruments or clocks. Since the observations made by a tracking system are imperfect, no trajectory fits these observations exactly. At best, only an estimate of the actual trajectory can be obtained from the data. GTDS uses either a classical weighted least squares estimator or a sequential estimator. Author

N76-24299* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARLY ORBIT METHODS
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 31 p refs (For availability see N76-24291 15-13)
CSCL 22A

The estimator algorithm in the Goddard Trajectory Determination System (GTDS) requires an a priori estimate of the spacecraft position and velocity in order to initiate the iterative estimation process. GTDS has been provided with the capability to determine a starting value of position and velocity from a limited number of discrete tracking data samples. Three techniques are optionally provided to perform this function. They are as follows: The Gauss method and double r-iteration method. These deterministic methods use three sets of chronologically ordered gimbal angle observation pairs to solve for the six Cartesian position and velocity components at an epoch time equal to that of the second observation: and the range and angles method. This method uses multiple (more than two) sets of simultaneously measured range and gimbal angle data from the GRARR, ATSR, USB or C-Band radar systems. Two body equations are regressively fitted to the transformed data to yield epoch values of the spacecraft position and velocity. Author

N76-24300* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRAJECTORY SENSOR SYSTEM FUNCTIONAL DESCRIPTIONS AND PREPROCESSING
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 34 p refs (For availability see N76-24291 15-13)
CSCL 22A

The trajectory sensor systems measure the various propagation characteristics of electromagnetic or optical signals transmitted between the satellite and tracking stations (or other reference sources). These data are subsequently used to determine the satellite trajectory. The dependence of these measurements upon the relative states of the spacecraft provides the key to the orbit determination process. Provided is a brief functional description of the trajectory sensing systems currently included in GTDS. Also described are the procedures followed in preprocessing the data prior to GTDS processing. These computations are independent of GTDS and are presented primarily for informational purposes. Author

N76-24301* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPENDIX B: TIME ELEMENTS
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 7 p (For availability see N76-24291 15-13)
CSCL 22A

The time regularized Cowell system of equations achieves analytic stepsize control through the transformation of the independent variable time to a new variables defined by dt/ds = sup alpha, where alpha is called the uniformization constant and r is the magnitude of the radius vector. The physical time t is obtained through integration of the equation which involves r. Any linear error in r will propagate into a nearly quadratic error in the time. Time elements are introduced to reduce this nearly quadratic error growth to a nearly linear error growth for perturbed motion. An element in two body motion is defined as a parameter which is either constant or a linear function of the independent variable. For perturbed motion (assuming small perturbations) an element varies slowly from the two body solution. Thus, in deriving a time element tau for the time regularized Cowell method, tau is required to vary linearly with the independent variables s. Author

N76-24302* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPENDIX C: DEVELOPMENT OF RANGE-RATE FORMULAS
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 14 p (For availability see N76-24291 15-13)
CSCL 22A

Formulas are developed which relate the tracker and spacecraft relative motion to the Doppler shift in an electromagnetic signal transmitted from one to the other. Author

N76-24303# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
ORBIT DETERMINATION STUDY FOR THE DORNIER SYSTEM/AEG-TELEFUNKEN/DFVLR TELEVISION BROADCASTING SATELLITE Final Report [ABSCHLUSSBEURTEILUNG DER STUDIE UEBER DIE BAHNVERMESSUNG DES FERNSEHRUNDFUNKSATELLITEN VON DORNIER-SYSTEM/AEG-TELEFUNKEN/DFVLR]
A. Leibold, F. Jochim, Herbert Schild, and K. Heintz Jun. 1975 57 p refs In GERMAN
(Contract GfW-011-013/73-FRS)
(DLR-A-552-75/31) Avail: NTIS HC $4.50

Orbital phases are discussed in some detail. The required and attainable orbit determination was investigated for the operational phase. Errors in terminal equipment were also evaluated. ESA

N76-24304# Royal Aircraft Establishment, Farnborough (England).
THE ORBIT OF ARIEL 4 (1971 - 109A)
R. H. Gooding Jul. 1975 36 p refs
(RAE-TR-75064; BR48180) Avail: NTIS HC $4.00

The definitive orbit of Ariel 4 was computed, from Minitrack observations, for the two periods during which orbital parameters were required for use in telemetry analysis - from December 1971 (launch) to May 1973, and from October to December 1973. The orbit was represented by a model with eight independent orbital parameters, and the values of these parameters were determined, and are listed, at three-day intervals. The accuracy was much the same for all the determinations, being about 0.000004 in eccentricity and 2 in. for the angular parameters; this would correspond to a nominal position accuracy of about 120 m in using the orbital parameters, though the actual errors may have approached 500 m at times, arising from perturbations due to unmodelled tesseral harmonics. Author (ESA)

N76-24305# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
ERROR ANALYSIS OF THE ORBIT DETERMINATION DURING OPERATION OF THE ARCOMSAT [FEHLERANALYSE DER BAHNBESTIMMUNG WAEHREND DES OPERATIONELLEN BETRIEBS DES ARCOMSAT]
A. Leibold and E. F. Jochim [1975] 27 p refs In GERMAN
(DLR-IB-552-75/8) Avail: NTIS HC $4.00

The orbit determination accuracy of the Arabian Commercial Satellite (Arcomsat), under development, was investigated

with regard to tracking stations, tracking systems, tracking strategies, and orbit determination software. Required position fixing accuracy is plus or minus 0.05 deg. in order to operate the many 10 m receiving stations without antenna readjustment. The orbit determination accuracy should be an order of magnitude less than the allowable position error. A computer program was used to transform estimated tracking errors and orbital model errors into orbit determination errors and therefore into orbit prediction errors. Results show that Cairo and Rabat or two similar locations can be used as tracking stations. The Italians should be equipped for range measurement. Two tracking strategies are proposed. ESA

N76-24306# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

AN APPROXIMATE SEMI-ANALYTICAL SOLUTION FOR ORBIT AND ATTITUDE MANEUVERS OF SPIN STABILIZED SATELLITES

M. Eckstein 24 Sep. 1975 35 p refs
(DLR-IB-552-75/9) Avail: NTIS HC $4.00

The mutual interaction of orbit-attitude maneuvers of spin stabilized satellites is investigated by application of the two-variable expansion procedure to the Euler equations. The resulting semi-analytical solution describes the short periodic nutation, the long term attitude variation and the mean linear acceleration of the center of mass. Some applications of the solution are shown by means of a few examples concerning attitude and orbit prediction, parameter determination and parameter optimization. Author (ESA)

N76-24307# Compagnia Industriale Aerospaziale S.p.A., Rome (Italy).

INVESTIGATION OF SPIN RATE FLUCTUATIONS OF THE ESRO 4 SATELLITE Final Report

A. Buratti and G. Fusco Oct. 1975 164 p refs
(Contract ESOC-626/74-AR)
(RL-75-242; ESA-CR(P)-794) Avail: NTIS HC $6.75

The analysis presented is based largely on telemetry data available. Physical mechanisms giving rise to the observed phenomenon are discussed and the orders of magnitude of their contribution are computed to identify the most important sources. The effect of eddy currents is modeled in detail. Temperature variation effects were investigated using a two and a three node model. Thermal flux effects due to albedo were analyzed with the model. An accurate mathematical representation for spin rate and phase, requiring a certain amount of data handling of measurements, is suggested, together with a simple one requiring less work. ESA

N76-24308# European Space Operations Center, Darmstadt (West Germany).

PERTURBATION OF A SATELLITE ORBITER BY THE OBLATENESS OF THE PRIMARY PLANET

E. A. Roth Paris ESA Dec. 1975 68 p refs
(ESA-SR-26-ESOC) Avail: NTIS HC $4.50

The perturbation is investigated produced by the oblateness of a giant planet (Jupiter, Saturn, Uranus or Neptune) acting on an orbiter around one of its large satellites. The perturbing force of the Jn-terms is expanded in an appropriate form in a double series of powers of a/p sub d and powers of t, and the variations of the orbital elements of the orbiter are derived. An example shows that the perturbation of the orbit cannot be neglected. Author (ESA)

N76-24309# Physical Sciences, Inc., Wakefield, Mass.

ADVANCED REENTRY AEROMECHANICS. VOLUME 2. AERODYNAMIC SHATTERING OF ICE CRYSTALS IN HYPERSONIC FLIGHT Interim Scientific Report

Girard A. Simons Apr. 1975 62 p refs Sponsored in part by SAMSO, Los Angeles, Calif.
(Contract F44620-74-C-0022)
(AD-A019517; PSI-TR-22; AFOSR-75-1668TR) Avail: NTIS CSCL 16/2

A theoretical study of ice crystal/shock layer interaction has been carried out in order to assess the relative kinetic energy of an ice crystal upon impact with a hypersonic vehicle. A dynamic fracture criterion has been developed which predicts the size of the ice crystal fragments formed at the vehicle bow shock. An analysis of the ice crystal breakup predicts that the outer fragments continue to shatter and prevent the shock layer gas from penetrating the fragment cloud. The fragment cloud is then treated as a deformable fluid drop, and the reduced impact velocity due to lateral spreading is determined. GRA

N76-24310# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

OPTIMAL MID-COURSE MODIFICATIONS OF BALLISTIC MISSILE TRAJECTORIES M.S. Thesis

Matthew P. Gillis, III Dec. 1975 144 p
(AD-A019333; GA/MC/75D-3) Avail: NTIS CSCL 16/2

The problem of finding optimal mid-course modifications of ballistic missile trajectories is investigated. A single velocity impulse is applied at the point of transfer from the original orbit to the modified trajectory. This limits the modified trajectory to one which intersects the original trajectory. Optimization of a weighted function of transfer velocity impulse and the time to impact after the modification occurs is accomplished. The function can be weighted to accommodate trade-offs between both components. The study is divided into two parts. Elliptical orbits for a non-rotating, atmosphere free earth are investigated, and then trajectories for an oblate, rotating earth with atmospheric reentry are examined. GRA

N76-24311# Aerospace Corp., El Segundo, Calif.

THE GENERALIZED TRAJECTORY SIMULATION SYSTEM. VOLUME 5: WEIGHT ESTIMATION MODELS FOR SIZING APPLICATIONS Final Report, 1 Jul. 1974 - 30 Jun. 1975

Charles C. DeBilzan 21 Nov. 1975 464 p
(Contract F04701-74-C-0075; F04701-75-C-0076)
(AD-A019111; TR-0076(6666)-1-Vol-5;
SAMSO-TR-75-255-Vol-5) Avail: NTIS CSCL 16/2

The Generalized Trajectory Simulation (GTS) system provides a vehicle design and trajectory simulation capability. GTS is written in FORTRAN compatible with CDC 7000/6000 series computer systems. User-oriented input data specifications, computational efficiency, diverse program applicability, and convenient program modifications have been primary considerations in the design of the GTS system. The trajectory simulation capability can accommodate diverse types of vehicle configurations, flight profiles, and mission objectives. Additionally, the GTS system contains an extensive vehicle sizing capability and a state-of-the-art optimization capability. This volume documents the GTS library of weight estimation models which provide a vehicle sizing capability for space and missile vehicles that use solid propellant rocket motors. Liquid propelled vehicles can also be accommodated within the sizing procedure; however, they require the development of specialized weight estimation models to represent particular characteristics of the desired liquid propellant system. Primary applications include preliminary design studies, booster subsystem trade-off studies, and growth studies of existing systems, including the analysis of advanced propellant technology or new launch concepts. GRA

N76-24312# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

TIME-OPTIMAL RENDEZVOUS FOR AN UPPER STAGE VEHICLE OF THE SPACE TRANSPORTATION SYSTEM M.S. Thesis

Raymond P. Johnson Dec. 1975 144 p refs
(AD-A019328; GA/MC/75D-4) Avail: NTIS CSCL 22/3

This study investigates minimum-time rendezvous trajectories and thrust control profiles for an upper stage vehicle of the Space Transportation System. A numerical technique is presented to solve the nonlinear two-point boundary value problem associated with the finite-thrust time-optimal trajectories. This method serves to reduce the associated computer burden through the use of a general-purpose subroutine developed by the mathematician M.J.D. Powell to solve a system of nonlinear equations. The general technique uses a gradient-type iteration when poorer estimates of the unknowns are encountered and, yet, switches automatically to the more rapid convergence of a Newton-Raphson scheme as the estimates are improved. The discontinuities associated with the on-off thrust control are overcome through an iterative determination of the related switching times. GRA

N76-24313# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE USE OF PRIMER VECTOR THEORY TO DERIVE TIME-OPTIMAL IMPULSIVE TRANSFERS M.S. Thesis
James M. Basine Dec. 1975 112 p
(AD-A019331; GA/MC/75D-1) Avail: NTIS CSCL 22/3

This study is concerned with minimum-time, impulsive rocket transfers in an inverse-square gravitational field between coplanar and noncoplanar orbits. The transfer profiles considered in this report are two and three-impulse trajectories. These profiles may also contain an initial or final coast. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-24314*# Aerotherm Acurex Corp., Mountain View, Calif.
DEVELOPMENT OF AN IMPROVED COATING FOR POLYBENZIMIDAZOLE FOAM Final Report
G. J. Neuner and C. B. Delano (Whittaker Corp.) Washington NASA May 1976 86 p refs
(Contract NAS2-8490)
(NASA-CR-2697; Rept-75-169) Avail: NTIS HC $5.00 CSCL 11C

An improved coating system was developed for Polybenzimidazole (PBI) foam to provide coating stability, ruggedness, moisture resistance, and to satisfy optical property requirements (alpha sub (s/epsilon) < or = 0.4 and epsilon > 0.8) for the space shuttle. The effort was performed in five tasks: Task 1 to establish material and process specifications for the PBI foam, and material specifications for the coatings; Task 2 to identify and evaluate promising coatings; Task 3 to establish mechanical and thermophysical properties of the tile components; Task 4 to determine by systems analysis the potential weight trade-offs associated with a coated PBI TPS; and Task 5 to establish a preliminary quality assurance program. The coated PBI tile was, through screening tests, determined to satisfy the design objectives with a reduced system weight over the baseline shuttle silica LRSI TPS. The developed tile provides a thermally stable, extremely rugged, low thermal conductivity insulator with a well characterized optical coating. Author

N76-24315*# TRW Systems Group, Redondo Beach, Calif.
SPACELAB COST REDUCTION ALTERNATIVES STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
1 Feb. 1976 47 p 3 Vol.
(Contract NAS9-14484)
(NASA-CR-147700; TRW-26904-6002-TU-00-Vol-1) Avail: NTIS HC $4.00 CSCL 22B

Alternative approaches to payload operations planning and control and flight crew training are defined for spacelab payloads with the goal of: lowering FY77 and FY 78 costs for new starts; lowering costs to achieve Spacelab operational capability; and minimizing the cost per Spacelab flight. These alternatives attempt to minimize duplication of hardware, software, and personnel, and the investment in supporting facility and equipment. Of particular importance is the possible reduction of equipment, software, and manpower resources such as comtational systems, trainers, and simulators. Author

N76-24316*# TRW Systems Group, Redondo Beach, Calif.
SPACELAB COST REDUCTION ALTERNATIVES STUDY. VOLUME 2: FINAL BRIEFING Final Report
9 Dec. 1976 217 p 3 Vol.
(Contract NAS9-14484)
(NASA-CR-147701; TRW-26904-6002-TU-00-Vol-2) Avail: NTIS HC $7.75 CSCL 22B

For abstract, see N76-24315.

N76-24317*# TRW Systems Group, Redondo Beach, Calif.
SPACELAB COST REDUCTION ALTERNATIVES STUDY. VOLUME 3: CREW TRAINING TASK ANALYSIS Final Report
1 Dec. 1975 100 p 3 Vol.
(Contract NAS9-14484)
(NASA-CR-147702; TRW-26904-6002-TU-00-Vol-3) Avail: NTIS HC $5.00 CSCL 22B

The on-orbit phase of flight was analyzed to identify the functions that had to be performed to meet flight objectives. The functions identified were combined into a top-level functional flow diagram (3.0 On-Orbit Operations). Each function, in turn, was analyzed to determine the major activities necessary to perform the function. The activities and activity sequences were presented in second level functional flow diagrams. Each major activity was further analyzed to define the operator tasks that are performed to accomplish that activity. Training analysis worksheets were used to document the analysis of each function down to the task level and provide training requirements data for each task. For Vol. 1, see N76-24315. Author

N76-24318# Naval Research Lab., Washington, D.C.
NTS-1 (TIMATION 3) QUARTZ AND RUBIDIUM-OSCILLATOR FREQUENCY-STABILITY RESULTS
Thomas B. McCaskill and James A. Buisson 12 Dec. 1975 25 p refs
(NRL Proj. R04-16)
(AD-A019156; NRL-7932) Avail: NTIS CSCL 17/7

The report describes frequency stability results obtained from the NTS-1 satellite. NTS-1 has three on-board frequency sources: one quartz oscillator and two rubidium resonators. These are used to derive the precise time and frequency signals radiated by the spacecraft. The data taken from each of three 2.5-hr daily passes are time difference (range) or frequency difference (Doppler). These data are incorporated into a single value for each pass which is subsequently used in computing long-time Allan-variance results. The results presented here employ single-frequency measurements at 335 MHz. Analysis of these results indicate an effect on measured frequency stability that correlates with a resonant term in the orbit. The results further indicate the rubidium frequency depends on the spacecraft temperature, which confirms previous NRL preflight analyses.
GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N76-24319*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ATMOSPHERIC SCIENCE FACILITY PALLET-ONLY MODE SPACE TRANSPORTATION SYSTEM PAYLOAD (FEASIBILITY STUDY), VOLUME 1 Interim Technical Report.
Nov. 1975 493 p refs
(NASA-TM-X-72958; JSC-10683-Vol-1-Rev-A) Avail: NTIS HC $12.50 CSCL 22B

The economic and technical feasibility is assessed of employing a pallet-only mode for conducting Atmospheric Magnetospheric Plasmas-in-Space experiments. A baseline design incorporating the experiment and instrument descriptions is developed. The prime instruments are packaged into four pallets

in a physical and functional manner compatible with the Space Transportation System capabilities and/or constraints and an orbiter seven-day mission timeline. Operational compatibility is verified between the orbiter/payload and supporting facilities. The development status and the schedule requirements applicable to the Atmospheric Science Facility mission are identified. Conclusions and recommendations are presented and discussed. Author

N76-24320*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 1: FINAL SUMMARY REPORT Volume 1 of Final Study Report
Dec. 1975 27 p
(Contract NAS9-14484)
(NASA-CR-147684; TRW-26904-H015-RO-00-Vol-1) Avail: NTIS CSCL 22A

An investigation to develop user oriented Space Transportation System (STS) payload mission control concepts was made. The objectives were to identify the requirements for flight control ground functions for representative STS payloads; investigate capabilities of present/planned NASA facilities for STS payload control; determine cost-effective system concepts; and, to develop implementation guidelines for proposed system options. The study schedule is summarized and study guidelines are presented. Representative flight types and payloads are presented, and STS system options are illustrated by communications traffic flow models. A system implementation timetable is presented. A.S.K.

N76-24321*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-A: FLIGHT CONTROL FUNCTIONS Final Study Report for Study Task A
24 Apr. 1975 98 p
(Contract NAS9-14484)
(NASA-CR-147685; TRW-26904-H002-RO-00-Vol-2-A) Avail: NTIS CSCL 22A

An analysis of flight control functions for representative space transportation system payloads is presented. Ground control duties for various missions using space shuttle-boosted payloads were determined. Data transmission and acquisition requirements are discussed. Representative missions were chosen from the 572 Flight Shuttle Traffic Model to determine control requirements. Control functions were allocated to ground control personnel or spacecrews depending on data processing and response time capabilities. A.S.K.

N76-24322*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-B: TYPES AND LOCATIONS OF PARTIES INVOLVED Final Study Report for Study Task B
23 May 1975 89 p
(Contract NAS9-14484)
(NASA-CR-147686; TRW-26904-H003-RO-00-Vol-2-B) Avail: NTIS CSCL 22A

Space Transportation System payload users are identified, and flight control facility utilization concepts are analyzed. Candidates for payload operations centers were evaluated according to facility resource usage, including computer system capabilities. Other criteria for selection included number of MCC interfaces, concentration of expertise, yearly down time, customized support, and documentation requirements. A.S.K.

N76-24323*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-C: GENERAL INVESTIGATION OF PRESENT/PLANNED NASA-WIDE FACILITIES AVAILABLE Final Study Report for Study Task C
8 Aug. 1975 59 p
(Contract NAS9-14484)
(NASA-CR-147687; TRW-26904-H004-RO-00-Vol-2-C) Avail: NTIS CSCL 22D

Criteria for evaluating present and planned capabilities of NASA facilites for mission control of Space Transportation System payloads are presented. The evaluation criteria include facility capability for payload monitoring; tracking and data acquisition; communications and data management; training and/or simulation; and, host facilities for payload management. A.S.K.

N76-24324*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-C: INVESTIGATION OF PRESENT/PLANNED NASA-WIDE FACILITIES AVAILABLE. APPENDIX A: NASA/ARC CAPABILITIES Final Study Report for Study Task C
8 Aug. 1975 79 p refs
(Contract NAS9-14484)
(NASA-CR-147688; TRW-26904-H005-RO-00-Vol-2-C-A) Avail: NTIS CSCL 22D

The Pioneer Mission Operations Control Center of the Ames Research Center (ARC) is described in detail. The ARC role in support of Space Transportation System payload mission control is discussed, and the facility capabilities for this role are evaluated. The major capabilities discussed are payload monitoring; tracking and data acquisition; communications and data handling; computation and data management; training and simulation; and payload host facilities. A.S.K.

N76-24325*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-C: INVESTIGATION OF PRESENT/PLANNED NASA-WIDE FACILITIES AVAILABLE. APPENDIX B: NASA/GSFC CAPABILITIES Final Study Report for Study Task C
8 Aug. 1975 156 p refs
(Contract NAS9-14484)
(NASA-CR-147689; TRW-26904-H006-RO-00-Vol-2-C-B) Avail: NTIS CSCL 22D

The payload operations facilities at the Goddard Spaceflight Center (GSFC) are described in detail. The GSFC role in support of Space Transportation System payload mission control is discussed, and the facility capabilities for this role are evaluated. The major capabilities discussed are payload monitoring facilities; tracking and data acquisition; communications and data handling; computation and data management; training and simulation; and, host facilities for payload operations. A.S.K.

N76-24326*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-C: INVESTIGATION OF PRESENT/PLANNED NASA-WIDE FACILITIES AVAILABLE. APPENDIX C: NASA/JPL CAPABILITIES Final Study Report for Study Task C
8 Aug. 1975 135 p refs
(Contract NAS9-14484)
(NASA-CR-147690; TRW-26904-H007-RO-00-Vol-2-C-C) Avail: NTIS CSCL 22D

The space flight operations facility of the Jet Propulsion Lab (JPL) is described in detail. The JPL role in support of Space Transportation System payload mission control is discussed and the facility capabilities for this role are evaluated. The major capabilities discussed are payload monitoring; tracking and data acquisition; communications and data handling; computation and data management; simulation and training; and, host facilities for payload operations. A.S.K.

N76-24327*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-C: INVESTIGATION OF PRESENT/PLANNED NASA-WIDE FACILITIES AVAILABLE. APPENDIX D: NASA/JSC CAPABILITIES Final Study Report for Study Task C
8 Aug. 1975 197 p refs
(Contract NAS9-14484)
(NASA-CR-147691; TRW-26904-H008-RO-00-Vol-2-C-D) Avail: NTIS CSCL 22D

The Lyndon B. Johnson Space Center (JSC) Mission Control Center is described in detail. The JSC role in providing centralized control for the space transportation system and interfaces for its associated payloads is discussed. The facility capabilities for this role are evaluated. The major capabilities discussed are payload monitoring; tracking and data acquisition; communications and data handling; computation and data management; simulation and training; and, host facilities for payload operations. A.S.K.

N76-24328*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-C: INVESTIGATION OF PRESENT/PLANNED NASA-WIDE FACILITIES AVAILABLE. APPENDIX E: NASA/KSC CAPABILITIES Final Study Report for Study Task C
8 Aug. 1975 45 p refs
(Contract NAS9-14484)
(NASA-CR-147692; TRW-26904-H009-RO-00-Vol-2-C-E) Avail: NTIS CSCL 22D

The pre-launch testing and launch control facilities of the John F. Kennedy Space Center (KSC) are described in detail. The KSC role in support of Space Transportation System payload mission control is discussed, and the facility capabilities for this role are evaluated. The major capabilities discussed are payload monitoring; tracking and data acquisition; communications and data handling; computation and data management; training and simulation; and, payload host facilities. A.S.K.

N76-24329*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-C: INVESTIGATION OF PRESENT/PLANNED NASA-WIDE FACILITIES AVAILABLE. APPENDIX F: NASA/LaRC CAPABILITIES Final Study Report for Study Task C
8 Aug. 1975 16 p refs
(Contract NAS9-14484)
(NASA-CR-147693; TRW-26904-H010-RO-00-Vol-2-C-F) Avail: NTIS CSCL 22D

The potential role of the Langley Research Center as a payload mission control center was investigated. The facility currently has no control center capability for payloads, but the capacities for payload monitoring; tracking and data acquisiton; communications and data handling; computation and data management; training and simulation; and, payload host facilities were evaluated. A.S.K.

N76-24330*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-C: INVESTIGATION OF PRESENT/PLANNED NASA-WIDE FACILITIES AVAILABLE. APPENDIX G: NASA/MSFC CAPABILITIES Final Study Report for Study Task C
8 Aug. 1975 93 p
(Contract NAS9-14484)
(NASA-CR-147694; TRW-26904-H011-RO-00-Vol-2-C-G) Avail: NTIS CSCL 22D

The Marshall Space Flight Center (MSFC) Huntsville Operations Support Center is described in detail. The MSFC role in Space Transportation System payload mission control is discussed and the facility capabilities for this role are evaluated. The capabilities discussed are payload monitoring; tracking and data acquisition; communications and data handling; computation and data management; training and simulation; and, payload host facilities. A.S.K.

N76-24331*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-D: ALLOCATION OF FLIGHT CONTROL GROUND FUNCTIONS Final Study Report for Study Task D
8 Aug. 1975 126 p
(Contract NAS9-14484)
(NASA-CR-147695; TRW-26904-H012-RO-00-Vol-2-D) Avail: NTIS CSCL 22D

Flight control ground functions are allocated between Space Transportation System operators and payload operators for each representative flight type/payload category. Operator guidelines and work functions are tabulated with various space shuttle/payload configurations to detail ground support requirements. A.S.K.

N76-24332*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-E: OPERATIONAL INFORMATION FLOW AND PROCESSING Final Study Report for Study Task E
30 Oct. 1975 119 p
(Contract NAS8-14484)
(NASA-CR-147696; TRW-26904-H013-RO-00-Vol-2-E) Avail: NTIS CSCL 22B

The communications and data processing requirements at the major interfaces of the Space Transportation System ground network are presented. A model predicting future spacecraft communication needs was developed. Point-to-point communications channels and signal processing requirements are identified at each station. A gross assessment of the match between system capabilities and requirements was made using a current payload data and payload flight traffic model. Shortcomings of existing data accumulation systems were identified and techniques for updating data processing and communications are recommended. A.S.K.

N76-24333*# TRW Systems Group, Redondo Beach, Calif.
SPACE TRANSPORTATION SYSTEM PAYLOADS MISSION CONTROL STUDY. VOLUME 2-F: DEFINITION OF SYSTEM CONCEPTS Final Study Report for Study Task F
Dec. 1975 116 p
(Contract NAS9-14484)
(NASA-CR-147697; TRW-26904-H014-RO-00-Vol-2-F) Avail: NTIS CSCL 22B

System concept options for flight control of Space Transportation System (STS) payloads are defined. Selection of Payload Operations Centers (POC) for three STS payloads were made. Each system concept option embodies a system configuration; a command and control concept; organization modules for mission control and payload support personnel; communications resources; and, computation and data base management resources. Initial POC selection criteria were based on cost factors, operational effectiveness, and responsiveness to the user. A.S.K.

N76-24334*# TRW Systems Group, Redondo Beach, Calif.
STS PAYLOADS MISSION CONTROL STUDY Final Progress Report
Oct. 1975 124 p Presented at STS Payload Operations Concept Studies, Moffett Field, Calif., 22-23 Oct. 1975
(Contract NAS9-14484)
(NASA-CR-147698) Avail: NTIS HC $5.50 CSCL 22B

Basic study tasks are described which produce documentation to meet the following objectives: (1) flight control functions, (2) NASA flight control capabilities, (3) function allocations, (4) operational communications and information processing plans, (5) alternative system concepts for STS payload flight control support, and (6) estimated additional resources for selected system concept(s). Author

N76-24335*# TRW Systems Group, Redondo Beach, Calif.
STS PAYLOADS MISSION CONTROL STUDY, EXECUTIVE SUMMARY BRIEFING
Dec. 1975 69 p Presented at Washington, D. C., Dec. 1975
(Contract NAS9-14484)
(NASA-CR-147699) Avail: NTIS HC $4.50 CSCL 22B

The following study objectives were investigated and results are briefly discussed: (1) identify flight control ground functions for representative STS payloads, (2) investigate present/planned NASA-wide facilities for STS payload control, (3) determine feasible, cost effective system concept options for flight control of STS payloads, and (4) development of implementation guidelines for proposed concept option(s). Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N76-24336# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF MINIATURE DIGITAL TELEMETRY SYSTEM M.S. Thesis

Guy Weaver Wicks and Michael Paul Waite Sep. 1975 91 p refs
(AD-A019382) Avail: NTIS CSCL 09/6

The paper describes the design improvements and packaging of a miniature multi-channel digital telemetry system for use in remote controlled aircraft experiments coordinated by the Aeronautical Engineering Department at the Naval Postgraduate School. The avionics package, comprised of data encoder, transmitter, power supply, and pod-mounted sensor package, is small and lightweight; has low current requirement; and can transmit up to nine channels of data. The system has been modified to accept either potentiometric or voltage-output transducers. The ground receiving station provides an analog voltage output for each data channel that is linearly dependent on the airborne sensor output. This thesis emphasizes the modifications made to the existing system to provide more versatility, greater dependability and ease of operation. GRA

N76-24297* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATION MODELS
In its Mathematical Theory of the Goddard Trajectory Determination System Apr. 1976 81 p refs (For availability see N76-24291 15-13)
CSCL 22C

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-24337*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF AN INVESTIGATION OF JET PLUME EFFECTS ON AN 0.010-SCALE MODEL (75-OTS) OF THE SPACE SHUTTLE INTEGRATED VEHICLE IN THE 9 X 7-FOOT LEG OF THE NASA/AMES UNITARY WIND TUNNEL (IA82B), VOLUME 1 Aerothermodynamic Data Report
P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Mar. 1976 869 p 2 Vol.
(Contract NAS9-13247)
(NASA-CR-144601; DMS-DR-2231-Vol-1) Avail: NTIS HC $21.25 CSCL 22B

The base pressure environment was investigated for the first and second stage mated vehicle in a supersonic flow field from Mach 1.55 through 2.20 with simulated rocket engine exhaust plumes. The pressure environment was investigated for the orbiter at various vent port locations at these same freestream conditions. The Mach number environment around the base of the model with rocket plumes simulated was examined. Data were obtained at angles of attack from -4 deg through +4 deg at zero yaw, and at yaw angles from -4 deg through +4 deg at zero angle of attack, with rocket plume sizes varying from smaller than nominal to much greater than nominal. Failed orbiter engine data were also obtained. Elevon hinge moments and wing panel load data were obtained during all runs. Photographs of the tested configurations are shown. Author

N76-24338*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF AN INVESTIGATION OF JET PLUME EFFECTS ON AN 0.010-SHALE MODEL (75-OTS) OF THE SPACE SHUTTLE INTEGRATED VEHICLE IN THE 9 X 7-FOOT LEG OF THE NASA/AMES UNITARY WIND TUNNEL (IA82B), VOLUME 2 Aerothermodynamic Data Report
P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Mar. 1976 890 p 2 Vol.
(Contract NAS9-13247)
(NASA-CR-144602; DMS-DR-2231-Vol-2) Avail: NTIS HC $21.25 CSCL 22B

For abstract, see N76-24337.

N76-24339*# Rockwell International Corp., Downey, Calif. Space Div.
SPACELAB USER IMPLEMENTATION ASSESSMENT STUDY (SOFTWARE REQUIREMENTS ANALYSIS). VOLUME 1: EXECUTIVE STUDY Final Report
Apr. 1976 53 p 2 Vol.
(Contract NAS1-12933)
(NASA-CR-144966-1; SD-76-SA-0028-1) Avail: NTIS HC $4.50 CSCL 22B

The primary objective of this study was to develop an integrated approach for the development, implementation, and utilization of all software that is required to efficiently and cost-effectively support advanced technology laboratory flight and ground operations. It was recognized that certain aspects of the operations would be mandatory computerized services; computerization of other aspects would be optional. Thus, the analyses encompassed not only alternate computer utilization and implementations but trade studies of the programmatic effects of non-computerized versus computerized approaches to the operations. A general overview of the study is presented. Author

N76-24340*# Rockwell International Corp., Downey, Calif. Space Div.
SPACELAB USER IMPLEMENTATION ASSESSMENT STUDY. (SOFTWARE REQUIREMENTS ANALYSIS). VOLUME 2: TECHNICAL REPORT Final Report
Apr. 1976 159 p 2 Vol.
(Contract NAS1-12933)
(NASA-CR-144966-2; SD-76-SA-0028-2) Avail: NTIS HC $6.75 CSCL 22B

The engineering analyses and evaluation studies conducted for the Software Requirements Analysis are discussed. Included are the development of the study data base, synthesis of implementation approaches for software required by both mandatory onboard computer services and command/control functions, and identification and implementation of software for ground processing activities. Author

N76-24341*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME ANOMALIES OBSERVED IN WIND-TUNNEL TESTS OF A BLUNT BODY AT TRANSONIC AND SUPERSONIC SPEEDS
Joseph D. Brooks Washington Jun. 1976 26 p refs
(NASA-TN-D-8237; L-10784) Avail: NTIS HC $4.00 CSCL 01A

An investigation of anomalies observed in wind tunnel force tests of a blunt body configuration was conducted at Mach numbers from 0.20 to 1.35 in the Langley 8-foot transonic pressure tunnel and at Mach numbers of 1.50, 1.80, and 2.16 in the Langley Unitary Plan wind tunnel. At a Mach number of 1.35, large variations occurred in axial force coefficient at a given angle of attack. At transonic and low supersonic speeds, the total drag measured in the wind tunnel was much lower than that measured during earlier ballistic range tests. Accurate measurements of total drag for blunt bodies will require the use of models smaller than those tested thus far; however, it appears that accurate forebody drag results can be obtained by using relatively large models. Shock standoff distance is presented from experimental data over the Mach number range from 1.05 to 4.34. Theory accurately predicts the shock standoff distance at Mach numbers up to 1.75. Author

N76-24342*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF PHASE CHANGE PAINT HEAT TRANSFER TESTS UTILIZING 0.040 SCALE 50% FOREBODY MODELS (NO. 82-0) OF THE ROCKWELL INTERNATIONAL SPACE SHUTTLE ORBITER IN AEDC VKF HYPERSONIC TUNNEL B (TEST OH54A) Aerothermodynamic Data Report
W. H. Dye (Rockwell Intern. Corp., Downey, Calif.) Apr. 1976 461 p refs
(Contract NAS9-13247)
(NASA-CR-144605; DMS-DR-2301) Avail: NTIS HC $12.00 CSCL 22B

Results of aerodynamic heating tests conducted in October 1974 on a space shuttle orbiter model using the phase change paint technique are presented. The model was a 0.040 scale representation of the forward 50 percent of the orbiter. Surface

roughness effects on boundary layer transition were investigated. Roughness was simulated by using steel balls varying in diameter from 0 (no balls) to 0.039 inch with 0.040 inch wide by 0.080 inch deep gaps. A nominal Mach number of 8 was tested with Reynolds number varying from 0.75 through 3.5 million per foot. Angle of attack was varied from 20 deg to 40 deg. Author

N76-24343*# Chrysler Corp., New Orleans, La. Space Div.
AEROHEATING (PRESSURE) CHARACTERISTICS ON A 0.010-SCALE VERSION OF THE VEHICLE 3 SPACE SHUTTLE CONFIGURATION (26-OTS) IN THE LANGLEY RESEARCH CENTER 4-FOOT WIND TUNNEL (IH4), VOLUME 1 Aerothermodynamic Data Report
R. B. Kingsland (Rockwell Intern. Corp., Downey, Calif.) May 1976 584 p
(Contract NAS9-13247)
(NASA-CR-144608; DMS-DR-2138-Vol-1) Avail: NTIS HC $13.75 CSCL 22B

The results of wind tunnel tests conducted on a 0.010-scale version of the Vehicle 3 Space Shuttle Configuration were presented. Pressure measurements were made on the launch configuration, orbiter alone, external tank alone, and solid rocket booster alone, to provide heat transfer pressure data. The tests were conducted for a Mach number range from 2.36 to 4.6 and Reynolds number range from 1.2 to 5 million per foot. The model was tested at angles of attack from -10 deg to 20 deg for a sideslip angle range from -5 deg to +5 deg and at sideslip angles from -5 deg to 48 deg for 0 deg angle of attack. Author

N76-24344# Washington Univ., Seattle. Applied Physics Lab.
STABILITY OF ULTIMATE MOTION IN AN ATTITUDE CONTROL SYSTEM WITH UNBALANCED THRUSTERS
H. A. Kolve and R. N. Clark 18 Dec. 1975 38 p refs Sponsored by AIAA Backup document for AIAA Synoptic scheduled for publication in Journal of Spacecraft and Rockets in Sep. 1976 Avail: NTIS HC $4.00

A single axis attitude control system employing an integral pulse frequency modulator and thrusters having unsymmetrical force characteristics was analyzed for the stability of its ultimate motion around a small equilibrium region, and for convergence of the system trajectory from large initial states to this region. A type of motion which for practical purposes is equivalent to a two pulse limit cycle is defined and referred to here as 'favorable motion.' Relationships among the several system parameters are established which ensure the existence of favorable motion. The dynamic behavior of this system is represented by a set of nonlinear difference equations. The desired relationships among the system parameters which guarantee favorable motion near the equilibrium region are found from some geometrical properties of these equations and their solutions. The analytical results are verified by experiments on a computer simulation, and are displayed conveniently on a single graph. Author

N76-24345# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
DEVELOPMENT OF A 50 kg TEST MISSILE WITH SOLID PROPULSION FOR INVESTIGATION OF PARACHUTE SCALE EFFECTS [ENTWICKLUNG EINES 50 kg-MESSFLUGKOERPERS MIT FESTSTOFFANTRIEB ZUR UNTERSUCHUNG DER MASSTABSEINFLUESSE BEI FALLSCHIRMEN]
H. Muehlhaus, K.-F. Doherr, D. Muenscher, and C. Saliaris Bonn DOKZENTBw 1975 54 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung Prepared jointly with MBB, Ottobrunn, West Ger.
(BMVg-FBWT-75-5) Avail: NTIS HC $4.50; DOKZENTBw DM 30

Results of the development and testing of the missile are presented. Its engine consists of clustered solid propellant engines. Four missiles were launched. Evaluation of these flight tests shows relatively high drag coefficients as a function of Mach number and an unexpected tilting of the missile by over two degrees after leaving the launch pad. As a result, parachute release took place in velocity ranges other than originally planned. Some 16 more test flights have been planned. ESA

N76-24346# National Aerospace Lab., Amsterdam (Netherlands). Div. Spaceflight.
THEORETICAL INVESTIGATION OF THE BASIC THERMAL PERFORMANCE OF MULTILAYER INSULATION BLANKETS
A. A. M. Delil and J. F. Heemskerk 1 May 1975 106 p refs Sponsored by Neth. Agency for Aerospace Programs
(NLR-TR-75063-U) Avail: NTIS HC $5.50

The thermal performance of multilayer insulation blankets consisting of parallel radiation shields, applied to thermal control and thermal insulation of specific spacecraft parts was investigated. The thermal performance of evacuated multilayer insulation blankets depends on three modes of energy transfer: radiation between the radiation shields, gas conduction in the residual interstitial gas, and solid conduction via the contacting interfaces. The importance of the contributions of the three heat transfer modes depends on many parameters, such as dimensions, boundary temperatures, shield emissivities, absorption, emission and scattering coefficients of the medium between the radiation shields, interstitial gas pressure, compressive load, and the thermal conductivities of the blanket components, interfaces, and disturbances. A mathematical approximation of these blankets is presented. The governing equations describing the heat transfer process in geometrically undisturbed blankets are derived from the supporting basic theory. This basic theory is elucidated extensively. The most important parameters and blanket material properties are discussed. Their influences on the thermal performance of blankets were calculated. The results were in fair agreement with the scarce experimental data obtained from literature but the need for more experimental data should be stressed. Author (ESA)

N76-24347# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
MODAL SURVEY TESTS ON THE SPACECRAFT STRUCTURE ITOS RCA 1769 701
E. Breitbach, F. Kiessling, and N. Niedbal Paris ESA Jan. 1976 95 p refs
(Contract ESTEC-1833/72)
(ESA-CR-573) Avail: NTIS HC $5.00

The normal mode characteristics of the ITOS structure were measured by means of modal survey tests. These tests were carried out mainly in order to check a dynamic finite element model. The basic theoretical relations and the test equipment are presented and the experimental methods as well as the test procedure described. The test results are discussed in detail and special emphasis is given to the measurement accuracy. Author (ESA)

N76-24348# Acurex Corp., Mountain View, Calif. Aerotherm Div.
PASSIVE NOSETIP TECHNOLOGY (PANT) PROGRAM Final Summary Report, 1 Apr. 1971 - 30 Jun. 1975
M. R. Wool Jun. 1975 50 p ref
(Contract F04701-71-C-0027)
(AD-A019186; Aerotherm-75-159; SAMSO-TR-75-250) Avail: NTIS CSCL 16/3

A summary of the the analytical and experimental activities performed on the Passive Nosetip Technology PANT program is given. The various test programs are identified and key test results are described. Analysis results in the areas of surface roughness effects on nosetip performance, nosetip shape change physics, graphite ablation modeling, and weather erosion effects modeling are summarized. Program results indicate the direction for future development of reentry vehicle nosetip materials and configurations. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-24349# Conservatoire National des Arts et Metiers, Paris (France). Lab. National d'Essais.

EVALUATION AND COMPARISON OF INERTIA MOMENT MEASURING EQUIPMENT FOR ESTEC [EVALUATION ET COMPARAISON DES MACHINES DE MESURE DU MOMENT D'INERTIE POUR LES BESOINS D'ESTEC]
[1975] 338 p In FRENCH
(Contract ESTEC-2220/74-HP)
(ESA-CR(P)-791) Avail: NTIS HC $10.00

Equipment for measuring the central moments of inertia of satellites was evaluated and compared; new measuring methods were also studied. The improvement of accuracy, in particular by using a comparative standard, was investigated. It is concluded that for medium sized spacecraft structures the best choice would be the pendulum suspended by torsion bar or by spiral spring.
ESA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-24350*# Lockheed Missiles and Space Co., Huntsville, Ala. Thermal and Fluid Physics Group.
SOLID ROCKET BOOSTER THERMAL RADIATION MODEL, VOLUME 1 Final Report
G. H. Watson and A. L. Lee Mar. 1976 143 p refs 2 Vol.
(Contract NAS8-31310)
(NASA-CR-144300; LMSC-HREC-TR-D496763-Vol-1) Avail: NTIS HC $6.00 CSCL 21H

A solid rocket booster (SRB) thermal radiation model, capable of defining the influence of the plume flowfield structure on the magnitude and distribution of thermal radiation leaving the plume, was prepared and documented. Radiant heating rates may be calculated for a single SRB plume or for the dual SRB plumes astride the space shuttle. The plumes may be gimbaled in the yaw and pitch planes. Space shuttle surface geometries are simulated with combinations of quadric surfaces. The effect of surface shading is included. The computer program also has the capability to calculate view factors between the SRB plumes and space shuttle surfaces as well as surface-to-surface view factors.
Author

N76-24351*# Lockheed Missiles and Space Co., Huntsville, Ala. Thermal and Fluid Physics Group.
SOLID ROCKET BOOSTER THERMAL RADIATION MODEL. VOLUME 2: USER'S MANUAL Final Report
A. L. Lee Mar. 1976 121 p 2 Vol.
(Contract NAS8-31310)
(NASA-CR-144301; LMSC-HREC-TR-D496763-Vol-2) Avail: NTIS HC $5.50 CSCL 21H

A user's manual was prepared for the computer program of a solid rocket booster (SRB) thermal radiation model. The following information was included: (1) structure of the program, (2) input information required, (3) examples of input cards and output printout, (4) program characteristics, and (5) program listing.
Y.J.A.

N76-24352*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
TANK HEAD IDLE OXYGEN HEAT EXCHANGER DEVELOPMENT FOR TUG ENGINE Final Report
T. C. Mayes and C. D. Limerick 21 May 1976 88 p refs
(Contract NAS8-31151)
(NASA-CR-144313; FR-7498) Avail: NTIS HC $5.00 CSCL 21H

The design, fabrication, and test for a breadboard oxygen heat exchanger is reported. This assembly will be used for the tank head idle mode operation of the RL10 Derivative II space tug main engine.
Author

N76-24353*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SRB ATTRITION RATE STUDY OF THE AFT SKIRT DUE TO WATER IMPACT CAVITY COLLAPSE LOADING
Charles D. Crockett Apr. 1976 50 p refs
(NASA-TM-X-73308) Avail: NTIS HC $4.00 CSCL 21H

A methodology was presented so that realistic attrition prediction could aid in selecting an optimum design option for minimizing the effects of updated loads on the Space Shuttle Solid Rocket Booster (SRB) aft skirt. The updated loads resulted in water impact attrition rates greater than 10 percent for the aft skirt structure. Adding weight to reinforce the aft skirt was undesirable. The refined method treats the occurrences of the load distribution probabilistically, radially and longitudinally, with respect to the critical structural response.
Author

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-24354# Naval Civil Engineering Lab., Port Hueneme, Calif. Civil Engineering Lab.
EFFECT OF ATMOSPHERIC AND LABORATORY IRRADIATION ON ATTENUATED TOTAL REFLECTANCE SPECTRA OF ORGANIC COATINGS Final Technical Note, Mar. 1966 - Jul. 1969
Peter J. Hearst Nov. 1975 29 p refs
(YF51543006)
(AD-A018908; CEL-TN-1411) Avail: NTIS CSCL 07/4

Attenuated Total Reflectance (ATR) spectra were obtained before and after irradiation of coating films as part of an investigation to develop better accelerated test methods for determining coating performance. The coatings included alkyd, oil, vinyl-alkyd, vinyl copolymer, partially hydrolyzed vinyl copolymer, epoxy-amine, and epoxy-polyamide films. Clear and pigmented films had previously been irradiated in air with a mercury arc amd with a xenon arc. These studies were extended to include longer xenon-arc irradiation and atmospheric exposures. 500-hour xenon-arc irradiation had little effect on alkyd film, slightly reduced the peak heights of a vinyl film, and produced a strong increase in the carbonyl absorption of an epoxy film. Five-month atmospheric exposure produced a general reduction in the peak heights of the ATR spectra of alkyd, vinyl, and epoxy films and produced increases in the carbonyl peaks of the epoxy films. Since the main effect on the surface of coating films, as judged by ATR spectra, is an increase in carbonyl content, this method of testing coatings appears most suited for those synthetic coatings that do not have strong initial carbonyl absorption.
GRA

N76-24355# Utah Univ., Salt Lake City. Dept. of Chemistry.
STUDIES OF MOLECULAR RELAXATION IN POLYPROPYLENEOXIDE SOLUTIONS BY DIELECTRIC RELAXATION AND BRILLOUIN SCATTERING
S. Yano, R. R. Rahalkar, S. P. Hunter, C. H. Wang, and R. H. Boyd 2 Jun. 1975 36 p refs
(Contract N00014-75-C-0908; NR Proj. 051-562)
(AD-A019180; TR-9) Avail: NTIS CSCL 07/3

Dielectric relaxation and Brillouin scattering are jointly used in studying molecular relaxation in polypropyleneoxide (PPO) and its solutions in methylcyclohexane. The dielectric method was applied to the more concentrated (100, 80, 60 volume percent) solutions over a wide temperature and frequency range (30 Hz to 8 GHz) in order that the variation in activation energy characteristic of glass-forming substance could be delineated. The present work extends previous work on the undiluted polymer to higher frequencies so that a total range of 12 decades in log f(max) as a function of temperature is now available. A maximum in the hypersonic attenuation versus temperature curve was observed in each polymer solution. The Brillouin scattering follows different activation parameters and occurs somewhat more rapidly than the dielectric relaxation.
GRA

N76-24356# Systems Science and Software, La Jolla, Calif.
LYNX: A LINKED EULERIAN AND LAGRANGIAN CODE, VOLUME 1 Final Report

J. K. Dienes, E. J. Halda, and J. E. Welch Aberdeen Proving Ground, Md. BRL Nov. 1975 99 p refs
(Contract DAAD05-72-C-0310)
(AD-A018740; BRL-CR-276-Vol-1) Avail: NTIS CSCL 07/3

A specialized computer program has been assembled that can calculate the effects of a deformable axisymmetric projectile impacting a visco-elastic medium. An earlier Eulerian code, EVE, was designed to calculate the impact of a rigid projectile with a visco-elastic medium. Another existing code, the Lagrangian CRAM, capable of calculating the deformation of a multi-material projectile due to pressure loading along the projectile surface, was adapted to the calculation of projectile deformation. The LYNX code was developed by modifying and linking these EVE and CRAM codes so that the EVE code provides a pressure loading along the projectile surface and the CRAM code calculates the resultant deformation and motion of the projectile. This process is repeated, using realistic time steps, for as long as the problem is of interest. A discussion of the program and the user-supplied input is given in Volume I of this report. A test calculation in which a lead cylinder impacts gelatin is described and discussed. The results of this calculation agree with measurements made at the Ballistic Research Laboratories. A listing of the version of the program which is operational on the S3 Univac 1108 facility is given in Volume II. Author (GRA)

N76-24357# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
THE EFFECT OF SHORT-PULSE LASER RADIATION ON COATINGS Research Report, 1 Feb. - 30 Jun. 1974
Jay A. Fox and Dallas N. Barr Apr. 1975 56 p
(DA Proj. 1T1-61101-A-91A)
(AD-A018864; USAMERDC-2138) Avail: NTIS CSCL 11/3

Results of a 4-month, experimental study of the interaction betweeen short laser pulses and coatings of paints and water are presented. In particular, objectives of the research include: (1) A determination of the fluence levels needed to sustain damage/modification of coatings; (2) an investigation of the impulsive loading on the substrate caused by the presence of these coatings; and (3) the identification of the basic laser/coating interaction mechanism. Author (GRA)

N76-24358# Naval Civil Engineering Lab., Port Hueneme, Calif.
PREDICTION OF PAINT PERFORMANCE FROM A COMBINATION OF ACCELERATED LABORATORY TESTS Final Technical Note, Dec. 1967 - Jun. 1971
Robert L. Alumbaugh and Peter J. Hearst Nov. 1975 46 p refs
(YF54593012)
(AD-A018954; CEL-TN-1412) Avail: NTIS CSCL 11/3

The Civil Engineering Laboratory investigated various accelerated laboratory test procedures for use in predicting the long-term performance of paint systems for steel exposed to a marine atmosphere. Accelerated laboratory test procedures included determining the electrical properties of the paint systems on steel panels (AC and DC resistance and AC capacitance), the water vapor permeability of free films of the paint systems, and the performance of the paint systems on steel panels exposed to a wet-and-dry-cycle test procedure. Results of the accelerated laboratory tests on 12 paint systems were correlated with their long-term performance in two different marine atmospheric environments using linear regression analysis. GRA

N76-24359# Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept.
EVALUATION OF VARIOUS PROTECTIVE COATINGS WHEN APPLIED UNDER ADVERSE CONDITIONS Final Report
George A. Gehring, Jr. 1 Dec. 1975 33 p
(Contract N00156-74-C-0620)
(AD-A018694; NAEC-ENG-7877) Avail: NTIS CSCL 11/3

An investigation was to develop meaningful performance data on various protective coatings applied under adverse conditions. The test program demonstrated the severity of the catapult environment on protective coatings and established basic guidelines for the specification of cost-effective primer coatings in the typical catapult environment. Under conditions where a near white metal sandblast can be obtained, the optimum prime coat is an inorganic zinc-rich coating exclusive of flame-sprayed metal coatings. If a near white metal surface is unobtainable, preliminary test results indicate that a rust-stabilizing pretreatment, equivalent to Corroless (S), topcoated with a compatible coating will provide adequate service in the typical catapult environment. Three coatings tested in this program were determined to be compatible with Corroless (S). GRA

N76-24360# Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept.
LABORATORY TESTING OF THERMAL INSULATION AND WEATHERCOATS DESIGNED FOR SHIPBOARD WEATHER DECK SERVICE Final Report
George A. Gehring, Jr. 1 Dec. 1975 47 p
(Contract N00156-74-C-0620)
(AD-A018693; NAEC-ENG-7876) Avail: NTIS CSCL 11/3

A continuing maintenance problem on aircraft carriers is the corrosion of catapult steam valves. Corrosion of the valves is caused by contact with sea water and other contaminants running down from the flight deck and penetrating thermal insulation around the valves. A program was designed to determine more effective weathercoats and possibly alternate insulating systems for use on the catapult valves. The program was conducted under realistically simulated conditions. The program rated twenty weathercoats on their resistance to sea water penetration; on their relative flammability; on their impact resistance; and on their stability in a simulated catapult environment. Also, five different types of blanket-wrap insulation were evaluated for stability in an environment simulating a weather deck exposure near the catapults. This report presents the results of the program. Color illustrations are reproduced in black and white. GRA

N76-24361# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
REPORT OF THE MATERIALS RESEARCH COUNCIL, 1975 Summary Report, 30 Apr. - 1 Sep. 1975
Maurice J. Sinnott Sep. 1975 108 p
(Contract DAHC15-71-C-0253; ARPA Order 2341-2)
(AD-A019238) Avail: NTIS CSCL 11/2

This report is a summary of the activities of the Materials Research Council for the period 30 April 1975 through September 1975. The 1975 summer conference was held at the Scripps Elementary School in La Jolla, California, during the period June 30 through July 25. It was the consensus of the Steering Committee that there should be four areas examined at the 1975 Conference. They were: (1) Powder Metallurgy and Forming; (2) One- and Two-Dimensional Conduction; (3) Optical Electronics; and (4) Wear. Two additional study areas were suggested by ARPA-MATS. One on the Materials-Design Interface and the second on Chemical Feedstocks. This report provides a summary of these papers. GRA

N76-24362# LTV Aerospace Corp., Dallas, Tex. Systems Div.
OPTIMIZATION OF PROCESSING VARIABLES WHICH AFFECT ADHESION OF ORGANIC COATINGS TO ANODIZED ALUMINUM ALLOYS Final Report, 16 Oct. 1974 - 15 Oct. 1975
A. B. Featherston Oct. 1975 71 p refs
(Contract N00019-75-C-0087)
(AD-A019541; Rept-2-57110/5R-3240) Avail: NTIS CSCL 11/3

The report describes the results obtained in a study program to improve adhesion between anodized aluminum and presently used organic coating systems. The blister test method was used which uses fluid pressure under the coating through a hole in the substrate to cause adhesive failure. Specimens were evaluated in both the 'as prepared' condition and after being subjected to 30 day alternate salt water immersion conditioning. Several anodizing processes were compared for adhesion characteristics. Special emphasis was placed on determining the anodizing variables which affect adhesion and in the determination of optimum processing parameters for both chromic acid and sulfuric acid anodizing. These evaluations used 2024 and 7075 aluminum alloy which were anodized, contaminated and cleaned prior to coating with epoxy polyamide primer. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N76-24363* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET LIGHT REFLECTIVE COATING Patent
John B. Schutt, inventor (to NASA) Issued 18 May 1976 23 p Filed 28 Sep. 1973 Supersedes N74-10542 (12 - 01, p 0069)
(NASA-Case-GSC-11786-1; US-Patent-3,957,675; US-Patent-Appl-SN-401919; US-Patent-Class-252-300; US-Patent-Class-106-306; US-Patent-Class-250-372; US-Patent-Class-350-1) Avail: US Patent Office CSCL 11C

An ultraviolet light reflective coating is disclosed which exhibits high reflectance to ultraviolet light having wavelengths down to about 2,000 Angstrom units. The coating composition comprises a dispersion of barium sulphate in an aqueous solution of a water-soluble inorganic binder selected from the group consisting of alkali metal sulphates, ammonium sulphate and mixtures thereof. The coating is preferably employed in conjunction with an alkaline primer. Official Gazette of the U.S. Patent Office

N76-24364*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Space Shuttle Engineering and Operations Support.
ADVANCED COMPOSITES: MECHANICAL PROPERTIES AND HARDWARE PROGRAMS FOR SELECTED RESIN MATRIX MATERIALS
Erwin K. Welhart 31 Mar. 1976 38 p refs
(Contract NAS9-13970)
(NASA-CR-147705; Rept-1.2-DN-B-0104-1) Avail: NTIS HC $4.00 CSCL 11D

This design note presents typical mechanical properties tabulated from industrial and governmental agencies' test programs. All data are correlated to specific products and all of the best known products are presented. The data include six epoxies, eight polyimides and one polyquinoxaline matrix material. Bron and graphite are the fiber reinforcements. Included are forty-two summaries of advanced (resin matrix) composite programs in existence in the United States. It is concluded that the selection of appropriate matrices, the geometric manner in which the fibers are incorporated in the matrix and the durability of the bond between fiber and matrix establish the end properties of the composite material and the performance of the fabricated structure. Author

N76-24365*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF LIGHTWEIGHT FIRE RETARDANT, LOW-SMOKE, HIGH-STRENGTH, THERMALLY STABLE AIRCRAFT FLOOR PANELING Final Report
D. B. Arnold, J. V. Burnside, and J. V. Hajari Apr. 1976 74 p
(Contract NAS9-14753)
(NASA-CR-147750) Avail: NTIS HC $4.50 CSCL 11D

Fire resistance mechanical property tests were conducted on sandwich configurations composed of resin-fiberglass laminates bonded with adhesives to Nomex honeycomb core. The test results were compared to proposed and current requirements for aircraft floor panel applications to demonstrate that the fire safety of the airplane could be improved without sacrificing mechanical performance of the aircraft floor panels. Author

N76-24366# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
JOINING OF FIBER REINFORCED ALUMINUM BY DIFFUSION WELDING [FUEGEN VON FASERVERSTAERKTEM ALUMINIUM DURCH DIFFUSIONSSCHWEISSEN]
E. VanRensen Bonn DOKZENTBw 1975 51 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-75-11) Avail: NTIS HC $4.50; DOKZENTBw DM 30.00

Different joint designs of boron-aluminum sheets were prepared by the diffusion bonding technique. These joints were tested by static and dynamic loads. Single and double lap scarf joints and stepped-lap joints were made with overlap lengths of 5, 10, and 15 mm. The shear strength exceeds 14 kp/sq mm. The ratio of the overlap length to the thickness of the sheet was great enough to avoid shear fractures. Generally the fractures originate from notches in the overlap region. The influence of different overlap lengths and various joint designs on the magnitude of notch strain was discussed. Author (ESA)

N76-24367# Bristol Univ. (England). Dept. of Electrical Engineering.
THE DYNAMIC PROPERTIES OF CARBON AND GLASS FIBRE REINFORCED PLASTICS Ph.D. Thesis
Denis Gordon Charles Bacon 1973 198 p refs Sponsored by Sci. Res. Council
Avail: NTIS HC $7.50

The dynamic properties were investigated in torsion and flexure. An apparatus is described for measuring the flexural damping and dynamic Young modules of beam specimens up to 25,000 lbf/sq in. Symmetric free-free flexural modes of vibration are excited and extraneous sources of damping reduced to a low level despite the difficulties of producing high amplitude vibration. Results are given for the damping and dynamic modulus in flexure and longitudinal shear with fiber volume fraction of zero deg unidirectional composites. ESA

N76-24368# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
GLASS FIBER REINFORCED PLASTICS FOR SMALL AIRCRAFT STRUCTURES. ACTIVITIES OVER THE YEARS 1956 TO 1971 IN THE LIGHT AIRCRAFT DIVISION
Albert Mylius 5 Dec. 1973 29 p In GERMAN; ENGLISH summary
(MBB-UFE-1067-0) Avail: NTIS HC $4.00

Examples are given of the application of glass fiber reinforced plastics to structural and nonstructural members of light aircraft developed by MBB. ESA

N76-24369# Army Materials and Mechanics Research Center, Watertown, Mass.
NEW MATERIALS AND CONSTRUCTION FOR IMPROVED HELMETS Monograph Series Report Final
Anthony L. Alesi, Richard P. Ames, Roger A. Gagne, Alan M. Litman, and Joseph J. Prifti Nov. 1975 17 p
(AD-A018958; AMMRC-MS-75-9) Avail: NTIS CSCL 11/4

The feasibility of using several new armor materials in the development of combat helmets was demonstrated on the basis of laboratory tests for fragment protection capabilities and for durability. The materials considered were (1) phenolic/polyvinyl butyral bonded fabric of Kevlar, a high-strength, high-modulus aromatic polyamide fiber; (2) a rigid laminate of XP, a highly stretched polyolefin film; (3) polyester bonded glass fabric of LMLD, a low-modulus, low-density glass fiber; and (4) a composite system of XP encapsulated between laminated skins of polyester bonded glass fabric (GRP) and Kevlar fabric. Molding procedures were developed to obtain durable constructions without undue sacrifice of ballistic penetration resistance capabilities. The M-1 helmet shapes were molded from all these materials except for the LMLD, the processing for which is the same as for ordinary fiberglass. These materials offer substantially improved protection capabilities against the broad weight range of anti-personnel munition fragments. GRA

N76-24370# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
STATIC AND FATIGUE TESTS OF F-111B BORON WING TIP
Murray N. England Jun. 1975 43 p
(AF Proj. 698CW)
(AD-A018751; AFFDL-TR-75-27) Avail: NTIS CSCL 11/4

This report describes the structural integrity tests of the F-111B boron-epoxy wing tip. A single test specimen was subjected to static load tests, static load plus internal pressure in the fuel cell tests, a fatigue test simulating four service lifetimes and residual strength tests. Results are discussed. GRA

N76-24371# Illinois Univ., Urbana. Coordinated Science Lab.
THE ADHESION, FRICTION, AND WEAR OF SPUTTERED TITANIUM CARBIDE COATINGS ON POLISHED STEEL SUBSTRATES
Lawrence Ching-Yu-Wu Dec. 1975 70 p refs

(Contract DAAB07-72-C-0259; Grant NSF DMR-74-15101) (AD-A019423; R-711; UILU-ENG-75-2247) Avail: NTIS CSCL 11/3

The objectives of the research program were to investigate the friction and wear behavior of sputter deposited TiC coatings on polished steel substrates. The variables investigated included rubbing speed, normal load and film thickness. A pin-on-disc machine was constructed for making the friction and wear measurements. As highly adherent films were desirable for this study, the initial work of Greene and Pestes was extended to include the influence of Argon sputtering pressure on adhesion. Films used for wear measurements were those in which adhesion was optimized through control of substrate temperature, substrate bias, and Argon sputtering pressure. GRA

N76-24372# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.

NUMERICAL ANALYSIS OF LAMINATED, ORTHOTROPIC COMPOSITE STRUCTURES Contract Report, 1 Jan. - 31 Dec. 1974

A. R. Zak Nov. 1975 113 p refs

(Contract DAAD05-73-C-0197; DA Proj. 1M5-62603-A-286) (AD-A018875; BRL-CR-272) Avail: NTIS CSCL 11/4

This report presents the two main lines of investigation which were carried out during the past contract year. One investigation was intended to check-out previously developed finite-element computer programs on a large degree-of-freedom composite material model. This was done by applying the analysis to a recoilless rifle configuration. The finite-element grid and the numerical results for this problem are presented and discussed. The second line of investigation was concerned with developing fracture models for composite materials. Two different models were developed. One model deals with interlaminar failure and the other predicts the matrix failure within an individual composite ply. No suitable experimental results are presently available to check out the first model but the second model is found suitable for explaining experimental results dealing with a nonlinear response of certain cylindrical models loaded to failure by internal pressure. These results, obtained from experiments performed at the Ballistic Research Laboratories, show that pronounced nonlinear structural response occurs at a fraction of failure load which suggests that an appreciable degradation of material occurs at relatively low stress levels. It is shown that this phenomenon can be explained by a model that assumes that the shear modulus in the plane of the fibers is reduced by matrix material failure parallel to the fibers. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N76-24373*# Scientific Translation Service, Santa Barbara, Calif.

THE INFRARED SPECTRUM AND THE STRUCTURE OF NO3Cl AND NO3F

A. J. Arvia, L. F. R. Cafferata, and H. Schumacher Washington NASA Jun. 1976 13 p Transl. into ENGLISH from Chem. Ber. (West Germany), v. 96, no. 5, 1963 p 1187-1194

(Contract NASw-2791)

(NASA-TT-F-15471) Avail: NTIS HC $3.50 CSCL 07D

A detailed study is made of the infrared spectra of NO3Cl and NO3F. Based on the number of bands found which are assigned as fundamental vibrations, and the nature of their rotational structure, it is concluded that the structure is planar. Author

N76-24374*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PHOTOELECTROLYTIC PRODUCTION OF HYDROGEN USING SEMICONDUCTOR ELECTRODES Interim Report

Charles E. Byvik and Gilbert H. Walker Mar. 1976 16 p refs

(NASA-TM-X-72830) Avail: NTIS HC $3.50 CSCL 07D

Experimental data for the photoelectrolytic production of hydrogen using GaAs photoanodes was presented. Four types of Ga-As anodes were investigated: polished GaAs, GaAs coated with gold, GaAs coated with silver, and GaAs coated with tin. The maximum measured efficiency using a tungsten light source was 8.9 percent for polished GaAs electrodes and 6.3 percent for tin coated GaAs electrodes. Author

N76-24375# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DEVELOPMENT OF THE COMBUSTION ZONE IN A STABILIZED TURBULENT FLAME Ph.D. Thesis - Paris Univ.

Vir Pratap Singh 1975 53 p refs In FRENCH; ENGLISH summary Sponsored by Direc. des Rech. et Moyens d'Essais Report will also be announced as translation

(ONERA-NT-1975-7) Avail: NTIS HC $4.50

A method of analysis is proposed as to how the turbulent flames stabilized in hot gases flowing at a high velocity can be treated theoretically. The theory is based on two basic parameters: turbulent burning rate and time of combustion. In order to verify the validity of the assumptions, the results of the numerical calculations were confronted with experimental results obtained at ONERA. These experiments were carried out on a test rig consisting of a combustion chamber 1300 mm long and of 100 mm x 100 mm cross-section. Premixed and preheated air-methane mixtures were supplied to the combustion chamber and the flame was initiated and stabilized by a parallel flow of hot burnt gases. Inlet velocities varied from 28 m/s to 80 m/s. The pressure plots along the axis of the combustion chamber were used to derive the above two parameters of turbulent combustion. The results obtained confirm the validity of the assumptions made. They also indicate the presence of a strong flame-generated turbulence. This study permits the theoretical analysis of a combustion chamber of revolution. It has been extended to the case of a turbojet after-burner in which flames are stabilized with one or several annular flame holders.

Author (ESA)

N76-24376+ National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.

BIBLIOGRAPHY OF INFRARED SPECTROSCOPY THROUGH 1960, PART 1 Final Report

J. J. Comeford, C. N. R. Rao, S. K. Dikshit, S. A. Kudchadker, and D. S. Gupta Jan. 1976 795 p Prepared in cooperation with Indian Inst. of Tech., Kanpur

(PB-249160/3; NBS-SP-428-Pt-1; LC-75-619218-Pt-1) Avail: NTIS HC $18.75 Also available in set of 3 reports as PB-249159-SET, HC $56.00 CSCL 07D

This bibliography is based on a systematic search of the literature on infrared spectroscopy up to the end of 1960. It covers, directly or through abstract journals, 121 periodicals. As a general rule, any paper of interest in the field of infrared spectroscopy is included. Substance coverage is provided in four sections: organic compounds, inorganic compounds, polymeric compounds, and minerals and ores. Information provided includes: empirical formula, compound name, range of wavelenghts reported, state of material, type of data presented in paper, and literature reference. Issued in three parts. The section on organic compounds is contained in volumes 1, 2, and part of volume 3; the other sections (inorganic compounds, polymeric compounds, minerals, and ores) are contained in volume 3. GRA

N76-24377 National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.

BIBLIOGRAPHY OF INFRARED SPECTROSCOPY THROUGH 1960, PART 2 Final Report

J. J. Comeford, C. N. R. Rao, S. K. Dikshit, S. A. Kudchadker, and D. S. Gupta Jan. 1976 811 p Prepared in cooperation with Indian Inst. of Tech., Kanpur

(PB-249161/1; NBS-SP-428-Pt-2; LC-75-619218-Pt-2) Avail: NTIS HC $21.25 Also available in set of 3 reports as PB-249159-SET, HC $56.00 CSCL 07D

For abstract, see N76-24376.

N76-24378+ National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.

BIBLIOGRAPHY OF INFRARED SPECTROSCOPY THROUGH 1960, PART 3 Final Report
J. J. Comeford, C. N. R. Rao, S. K. Dikshit, S. A. Kudchadker, and D. S. Gupta Jan. 1976 793 p Prepared in cooperation with Indian Inst. of Tech., Kanpur
(PB-249162/9; NBS-SP-428-Pt-3; LC-75-619218-Pt-3) Avail: NTIS HC $18.75 Also available in set of 3 reports as PB-249159-SET, HC $56.00 CSCL 07D
For abstract, see N76-24376.

N76-24379# Stanford Research Inst., Menlo Park, Calif.
CHARACTERISTICS OF FIRES IN STRUCTURAL DEBRIS Final Report, Jul. 1973 - Jan. 1975
S. J. Wiersma 27 Jan. 1975 58 p refs
(Contract DAHC20-70-C-0300)
(AD-A018798) Avail: NTIS CSCL 21/2
Results of an experimental study of fire behavior in structural debris are reported. The study was conducted in two phases -- the first in the laboratory, the second, involving large-scale burns, in the field. In both phases, debris-fire behavior was observed, rates of fire spread, durations of active flaming (i.e., residence time), and concentrations of gas effluents were measured, and the dependence of the observed and measured debris-fire characteristics on wind speed and on variables in debris composition were investigated. GRA

N76-24380# Army Materials and Mechanics Research Center, Watertown, Mass.
THE MASS SPECTROMETRIC INVESTIGATION OF THE CHEMICAL VAPOR DEPOSITION PROCESS FOR ALUMINA Final Report
Sin-Shong Lin Oct. 1975 22 p
(DA Proj. 1T1-61102-B-32A)
(AD-A018717; AMMRC-TR-75-20) Avail: NTIS CSCL 07/4
Mass spectrometric analysis has been made of the chemical vapor deposition process for alumina from gaseous reagents of Cl2/H2 over aluminum metal and H2O/O2 or oxygen. The experiments were performed in a specially designed concentric furnace followed by a high pressure sampling technique and mass spectrometric detection. From the analysis of Al2O3 deposits, it is found that opaque to transparent polycrystalline alumina can be prepared by a proper combination of gaseous reagents at selected temperatures. The optimum operating conditions and appropriate gaseous mixtures are described and recommended. Mass spectra reveal that the major aluminum chloride specie at deposition temperatures above 1,000 C is AlCl, contrary to earlier literature. The formation of solid Al2O3 in the present CVD process is a surface nucleation phenomena, and no vapor phase homogeneous nucleation occurs.
Author (GRA)

N76-24381# State Univ. of New York, Buffalo. Dept. of Chemistry.
THE INVESTIGATION OF PROPANE OXIDATION USING ELECTROCHEMICAL MASS SPECTROMETRY Semiannual Report, Jan. - Jun. 1975
T. M. Riedhammer and S. Bruckenstein Jun. 1975 51 p refs
(Contract DAAK02-71-C-0306; DA Proj. 1T0-61102-A-34A)
(AD-A019112; SAR-8) Avail: NTIS CSCL 07/4
An EMS study of the adsorption-desorption products of the electrooxidation of isobutane from porous platinum electrodes in 12 M H2SO4 at 105C was undertaken. Steady state and time dependent distributions of these products are presented at various electrode potentials. Steady state electrochemical current and charge data are also presented. A rotating platinum disk electrode study of the diffusion properties of methane, propane, carbon monoxide, hydrogen and oxygen was undertaken in trifluoromethane sulfonic acid monohydrate supporting electrolyte at 105C.
GRA

N76-24382# Block Engineering, Inc., Cambridge, Mass.
LASER RAMAN STUDY OF WATER VAPOR Final Report, 22 Apr. 1974 - Apr. 1975
Philip J. Miller, Anothony J. Modestino, and Stanley M. Klainer Dec. 1975 110 p refs
(Contract F40600-74-C-0013)
(AD-A018654; AEDC-TR-75-150) Avail: NTIS CSCL 07/4
Low resolution experimental measurements of the Raman Stokes scattering cross-sections and band shapes of water vapor are presented as a function of temperature. The trace scattering theoretical band profiles are compared satisfactorily to the experimental results. The results indicate that low resolution Raman data of water vapor may be used to obtain temperature and specie density information in flames. Author (GRA)

N76-24383# Army Tank-Automotive Command, Warren, Mich.
USE OF ATOMIC ABSORPTION SPECTROMETRY IN THE DETERMINATION OF COPPER IN SPECIFICATION CCC-C-428 MATERIALS
Cosby Bramlett Apr. 1975 17 p
(AD-A012153; TACOM-TR-12035) Avail: NTIS CSCL 07/2
This is a report of the development of an atomic absorption technique for the determination of the total copper in fungicides. The method was successfully applied to different types of materials containing copper and conforming to specification requirements. The analytical method is detailed in the appendix.
GRA

N76-24384# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF PRE-IGNITION PROCESSES IN ZIRCONIUM, TITANIUM AND ZIRCONIUM HYDRIDE
B. M. Zlobinskii 9 Dec. 1975 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (USSR), no. 3, 1973 p 114-116
(AD-A019166; FTD-ID(RS)I-2429-75) Avail: NTIS CSCL 21/2
Experiments were conducted on particles of electrodeposited zirconium (99.96% Zr), magnesium-thermal titanium (94.6% Ti) and zirconium hydride (ZrH2). The described mechanism of oxidation takes place during the entire process of heating. GRA

N76-24385# Systems Research Labs., Inc., Dayton, Ohio.
MASS SPECTROMETRIC STUDIES Final Report
E. G. Jones Jul. 1975 223 p refs
(Contract F33615-73-C-4099; AF Proj. 7023)
(AD-A019521; AFOSR-75-1510TR) Avail: NTIS CSCL 07/4
Mass-spectrometric investigations of diverse areas ranging from the basic understanding of elementary physical-chemical processes to analyses of trace elements in the environment are outlined. Basic thermodynamics and chemical kinetics of ion-neutral phenomena relevant to the solution of problems of immediate importance to the U.S. Air Force are emphasized. Particular emphasis is placed on electron-affinity determinations of small gaseous species of importance as electron scavengers in the atmosphere, and electronic excitation in ion-neutral collision processes of direct application to the understanding and prediction of new laser systems. Sophisticated analytical techniques to quantify trace contaminants such as dioxin in Herbicide Orange and other impurities in solid, liquid, and gaseous environmental samples are outlined. These include sample work-up, column preparation, and gas-chromatographic mass-spectrometric analysis. Techniques for quantitative adsorption and desorption of noxious gases on selectively prepared columns are described. Methods of computer interfacing with mass spectrometers for data acquisition are outlined. These include techniques for treating data from both chemical-physical and analytical investigations.
GRA

N76-24386# California Univ., Livermore. Lawrence Livermore Lab.
BASIC PRINCIPLES OF CHEMISTRY AND PHYSICAL CHEMISTRY
Carlos A. Colmenares 13 Oct. 1975 242 p refs
(Contract W-7405-eng-48)
(UCID-16933) Avail: NTIS HC $7.60
A course designed to provide communications between the designer of a system such as a mechanical engineer or a physicist and the material scientist such as a chemist or chemical engineer is presented. The topics discussed are stoichiometric principles, behavior of ideal gases, vapor pressure, humidity and saturation, solubility of gases in liquids, diffusion of gases, chemical reaction kinetics, and application of concepts to compatibility problems. The appendix provides problems to be used in conjunction with TV lectures. ERA

N76-24387 Sheffield Univ. (England).
DEVELOPMENT AND ASSESSMENT OF AN AUTOMATIC SYSTEM FOR ANALYZING CHEMICAL REACTIONS Final Report, 1 Nov. 1973 - 30 Apr. 1975
Michael F. Lynch Jul. 1975 21 p refs
(BLL-RD-5236-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

Work was continued on the development and assessment of an automatic system for analyzing chemical reactions. It was shown that, although methods based on connection tables certainly afforded more precise characterization of particular reactions, the proportion of the file to which the methods were applicable was not sufficiently large to hold promise of basing a practical system on them. However, methods based on the comparison of Wiswesser line notation symbol strings produced characterizations of a much higher proportion of the reactions in the file and, with some further development, could provide a basis for simple printed indexes of reaction change. Author

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-24388 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF THE SOLUBILITY OF CARBON IN MOLTEN NICKEL AND COBALT
Yu. V. Pozhidaev, B. P. Burylev, and I. E. Dobrovinskii [1975] 9 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 10, 1975 p 22-25 In ENGLISH and RUSSIAN
(NLL-M-25317-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The solubility of carbon in cobalt in the 1400-1700 C range and in nickel in the 1350-1650 C range was studied experimentally by the method of high-vacuum isothermal holding. Equations were obtained for the relationship between temperature and carbon solubility. The conclusion is drawn that the theory of regular solutions is applicable to the systems in question. Negative deviations from Raoult's law must occur in the Ni-C and Co-C binary systems. This conclusion is validated in the case of the former system by the regular experimental data. No such data are known for the Co-C system. Author

N76-24389 National Lending Library for Science and Technology, Boston Spa (England).
WEAR-RESISTANCE OF CASTINGS OF HIGH-MANGANESE STEEL MELTED IN A BASIC OPEN-HEARTH FURNACE
S. L. Levin, G. M. Orlova, and A. Ya. Pokivailov [1975] 8 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 10, 1975 p 49-51 In ENGLISH and RUSSIAN
(NLL-M-25319-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Results are given of research conducted into the effects of deoxidizing high manganese steel with silicocalcium and inoculating it with FTsM-5 alloy. Steel melted by this technology has higher density, and 30% higher wear resistance, than steel which is not inoculated and has been deoxidized with 45% ferrosilicon and aluminum. Author

N76-24390 British Library Lending Div., Boston Spa (England).
METHOD FOR REMOVAL OF COATINGS
V. M. Gershov, P. I. Dzyubenko, and M. Ya. Medne Apr. 1976 3 p Transl. into ENGLISH from Russian Patent no. 428043 (Appl. no. 1749775/22-1, 18 Feb. 1972) 3 p
(BLL-RTS-10180) Avail: British Library Lending Div., Boston Spa, Engl: £2.00; 3 BLL overseas or 9 UK BLL photocopy coupons

An invention for stripping of metallic coatings, especially coatings of nickel and of cobalt is presented. The known method for removal of coatings of nickel and cobalt is by soaking in an ammonium hydroxide based solution. The proposed method differs in that hydrochloric hydroxylamine is added to the solution and the process is conducted at a temperature of 120 to 150 C. This enables the process to be speeded up. By the proposed method the nickel and cobalt are completely removed from a base of steel, for example, without corroding the latter. Author

N76-24391*# Scientific Translation Service, Santa Barbara, Calif.
THE EFFECTS OF ATMOSPHERIC HUMIDITY AND DURATION OF PRIOR-CORROSION IN ATMOSPHERE ON THE FATIGUE STRENGTH OF SOME ALUMINUM ALLOYS
M. Ito and K. Takeuchi Washington NASA Jun. 1976 16 p refs Transl. into ENGLISH from Sumitomo Keikinzoku Giho (Japan), v. 16, no. 1/2, Jan. 1975 p 17-22
(Contract NASw-2791)
(NASA-TT-F-15461) Avail: NTIS HC $3.50 CSCL 11F

A study was made on the effects of atmospheric relative humidity and duration of prior-corrosion in the atmosphere on the fatigue strength of 2024-T4, 5052-O, 5083-O, 7075-T6 and 7N01(ZG43)-F alloys. The following were given: (1) Fatigue strengths decreased with increase of atmospheric relative humidity. Specimens tested in atmospheres exceeding the relative humidity of 90% have lower fatigue strength by 1.3-4.0 kg/sq. mm compared to that of specimens tested in relative humidity under 20%. (2) The effect of atmospheric humidity on the fatigue life depended considerably on the kind of alloys and stress cycle ranges. (3) Reduction of fatigue strengths due to prior-corrosion appeared mainly during the initial 5 to 10 days and the reduction rate was approximately 20 to 25%. Author

N76-24392*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF MINOR REACTIVE METAL ADDITIONS ON FRACTURE TOUGHNESS OF IRON: 12-PERCENT NICKEL ALLOY AT-196 DEG AND 25 DEG C
Walter R. Witzke and Joseph R. Stephens Washington May 1976 38 p refs
(NASA-TN-D-8232; E-8555) Avail: NTIS HC $4.00 CSCL 11F

The slow bend precracked Charpy fracture toughness and tensile behavior of arc-melted and hot-rolled Fe-12Ni alloys containing up to 4 atomic percent reactive metal additions were determined at -196 C and 25 C after water quenching from three annealing temperatures. The fracture toughness of Fe-12Ni at -196 C was improved by small amounts of Al, Ce, Hf, La, Nb, Ta, Ti, V, Y, and Zr, but not by Si. Cryogenic toughness was improved up to 7.5 times that of binary Fe-12Ni and varied with the reactive metal, its concentration, and the annealing temperature. Author

N76-24393# Lehigh Univ., Bethlehem, Pa.
PRESSURE SINTERING AND CREEP DEFORMATION: A JOINT MODELING APPROACH Progress Report, 1 Jan. - 31 Dec. 1975
M. R. Notis Sep. 1975 15 p refs
(Contract E(11-1)-2408)
(COO-2408-2) Avail: NTIS HC $4.50

Studies were continued to compare the densification during later stages of pressure sintering to the creep deformation behavior for CoO and $MgAl_2O_4$ as a function of stress, temperature, grain size, and porosity. A multimechanism model combining both linear and nonlinear plastic flow elements was developed and densification maps were developed assuming that each of these elements are independent. Studies of the densification kinetics during final stage pressure sintering of both CoO and $MgAl_2O_4$ are interpreted in terms of both phenomenological and atomistic constitutive densification rate equations. For CoO, the densification kinetics indicate that at low stresses linear viscous mechanisms predominate, and that at higher stresses nonlinear plastic deformation mechanisms are operative; the rate-controlling process appears to be cation-lattice diffusion at low stresses and oxygen-lattice diffusion at high stresses. For $MgAl_2O_4$, the densification kinetics indicate nonlinear deformation with extrinsic oxygen-lattice diffusion as the rate-controlling mechanism.
Author (ERA)

N76-24394# Ames Lab., Iowa.
PROPERTIES OF STEELS AUSFORMED BY IMPACT EXTRUSION
V. F. Mayer and T. E. Scott 1975 27 p refs Presented at the Conf. on Hot Deformation of Austenite, Cincinnati

(Contract W-7405-eng-82)
(IS-M-45; Conf-751111-1) Avail: NTIS HC $5.00

Two commercial steels, AISI 4340 and 440A martensitic stainless, were impact extruded at temperatures between 1150 and 1775 F. Single pass reductions from 50 to 94 percent required durations of only about 10 to the -3 power s at average strain rates in the range 5 times 100 to 2.5 times 1,000 per sec. Evidence based on mechanical properties, microstructural observations--optical and T. E. M.--and calculated particle growth rates indicates that carbide particles cannot form during the high rate, single pass deformation. Implications consequent to this deduction that are germane to current understanding of the ausform strengthening mechanism are discussed. Author (ERA)

N76-24395# Brookhaven National Lab., Upton, N.Y.
EVALUATION OF BURST PROBABILITY FOR TUBES BY WEIBULL DISTRIBUTIONS
Samuel Kao Oct. 1975 15 p refs
(Contract E(30-1)-16)
(BNL-20734) Avail: NTIS HC $3.50

The investigations of candidate distributions that best describe the burst pressure failure probability characteristics of nuclear power steam generator tubes were continued. To date it was found that the Weibull distribution provides an acceptable fit for the available data from both the statistical and physical viewpoints. The reasons for the acceptability of the Weibull distribution are stated together with the results for the suitability of fit. In exploring the acceptability of the Weibull distribution for the fitting, a graphical method to be called the density-gram is employed instead of the usual histogram. With this method a more sensible graphical observation on the empirical density may be made for cases where the available data is very limited. Based on these methods estimates of failure pressure are made for the lefttail probabilities. Author (ERA)

N76-24396# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE EFFECT OF STIFFENERS ON FATIGUE CRACK PROPAGATION
H. Huth, J. J. Gerharz, and D. Schuetz 22 Sep. 1975 49 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verkehr
(LBF-FB-122/75) Avail: NTIS HC $4.00

The effects of stiffeners on the crack propagation behavior of a metal sheet are described. Possible forms of graphical data presentation are discussed. Influencing parameters are defined and their effects investigated. The results of an extensive parametric study, using a computer program, are presented in form of design graphs. The determination of the stress intensity factor by means of crack-propagation tests, strain measurements, finite element and analytical calculations is described. The accuracy of these methods and the required effort are compared.
Author (ESA)

N76-24397# Metallgesellschaft, A.G., Frankfurt am Main (West Germany). Metall-Lab.
MANUFACTURING, PROCESSING AND TESTING OF HAZELETT ALUMINUM CAST STRIP AND ITS ROLL-MILLED SEMIPRODUCT Final Report
Juergen Althoff, Wilhelm Brand, Ulrich Heubner, and Wolf Wunder Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1975 120 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-17) Avail: NTIS HC $5.50; ZLDI, Munich DM 25.20

The Hazelett method developed for continuous casting of broad strips, using extrusion, is discussed for aluminum and some of its alloys. A calculation was made of the heat balance in a Hazelett strip casting machine, with regard to temperature gradients in the mold, temperature of the cast strip leaving the mold, and the sump length. The casting technology, as elaborated for Al 99.5, AlMn, AlMg 1.5, AlMg 3, and AlMg 4.5 Mn is described, as well as the properties of various mold dressings. The properties of cast strips regarding surface quality, microstructure, variations in thickness, porosity, segregation, and heat cracks were evaluated. Conditions are described for welding of the shrinking porosity during subsequent hot rolling. Properties of hot and cold rolled strips were investigated. ESA

N76-24398# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.
STRESSES IN PIPE BENDS OF OVAL OR ELLIPTICAL CROSS SECTION SUBJECTED TO INTERNAL PRESSURE
Arnold Sys Dec. 1975 36 p refs Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MT-110) Avail: NTIS HC $4.00

A review is given of the different theoretical stresses which occur in a pipe-bend. The results of stress-measurements on three pipe-bends with an out-of-roundness varying from 0 to 5.5 % and with the following nominal dimensions are described: external diameter 274 mm; wall thickness 9.4 mm; inside radius of bending 1000 mm. After a brief discussion of the results a comparison is made between the experimental and theoretical stresses from which it was found that a close relation exists between the formula of Dvorak and the experimental results. A proposal which is based on the ASME code, is finally given to determine the admissibility for out-of-roundness in pipe bends.
Author (ESA)

N76-24399# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.
AGARD'S APPROACH TO FATIGUE AND FRACTURE RESISTANCE
R. J. H. Wanhill May 1975 46 p refs Presented at the 8th ICAF Symp., Lausanne, Switz., 2-5 Jun. 1975
(NLR-MP-75014-U) Avail: NTIS HC $4.00

The influence of microstructure on fatigue strength, fatigue crack propagation, fracture toughness, and stress corrosion in three types of material, aluminum alloys, titanium alloys, and high strength steels, is examined. ESA

N76-24400# IBM Watson Research Center, Yorktown Heights, N.Y.
PHOTOEMISSION STUDIES OF THE ELECTRONIC STRUCTURE OF METALS, ALLOYS AND COMPOUNDS Final Report, 1 Sep. 1970 - 31 Aug. 1975
Dean E. Eastman 31 Aug. 1975 21 p refs
(Contract F44620-70-C-0089; AF Proj. 9763)
(AD-A019531; AFOSR-75-1665TR) Avail: NTIS CSCL 07/4

The author has developed new photoemission techniques and performed studies of several noble and transition metals (Cu, Ag, Au, Ni, Pd, Cr, etc.), semiconductors (Si, Ge, GaAs, GaP, InSb, ZnSe, CdTe, etc.), the Pd-H metal-gas system, magnetic rare earth, uranium, and transition metal compounds (EuO, EuS, GdS, US, SmS, TmTe, NiO, CoO, etc.), chemisorbed molecules and atoms on surfaces (CO on Ni) and the semiconductor-metal and semiconductor-vacuum interface (Ge, GaAs, GaSb, InSb, Ge with Sb overlayer, GaAs with Pd overlayer, etc.). GRA

N76-24401# University Coll. of North Wales, Bangor. School of Physical and Molecular Sciences.
PREPARATION AND PROPERTIES OF A STABLE METALLIC FERROFLUID Annual Technical Report, Oct. 1974 - Oct. 1975
P. L. Windle, J. Popperwell, and S. W. Charles Sep. 1975 26 p refs
(Grant DA-ERO-75-G-025; DA Proj. 1T1-61102-B-32D)
(AD-A018858) Avail: NTIS CSCL 07/4

Results are presented in this report on the long term stability of metallic ferromagnetic liquids containing iron particles in mercury. The effect of various coatings is considered. In particular a tin coating is found to enhance the stability in the long term. A different method to introduce stability by controlling the contact potential between particle and fluid by the addition of sodium is described and shown to improve the stability to a point where the long term growth is negligible (the maximum radius being 40-45A). This is a very important development and leads to the possible uses of these fluids in devices such as magnetic seals and energy conversion systems. GRA

N76-24402# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF AUSTENITE REVERSION DURING AGING OF 10-NICKEL MODIFIED STEEL M.S. Thesis
John B. Longenecker Dec. 1975 83 p refs
(AD-A019329; GAE/MC/75-7) Avail: NTIS CSCL 11/6

The formation of retained austenite in 10-Nickel Modified Steel has been investigated at various aging combinations of temperature and time over the range 900 to 1200F and 0.5 to 12.0 hours. X-ray diffractometry analysis, using Mo (K sub alpha) radiation, was used to obtain data for the retained austenite measurements. Hardness data were used to correlate retained austenite with mechanical properties. Electron microscopic examination was conducted on specially-aged samples having a large grain size. The formation of retained austenite exhibited an Arhennius-type dependence on aging temperature and grain-boundary diffusion. Secondary hardening occurs for aging times less than one hour and aging temperatures less than 950F. Overaging occurs at longer times and higher temperatures. As aging times increase for aging temperatures below 1100F, the amount of retained austenite increases while the hardness decreases; however, above 1100F both the amount of retained austenite and hardness decrease. When heat treating at 1500F, an equilibrium grain size number of 2 is at 100 hours. As the actual grain size increased, both the amount of retained austenite and the hardness decreased. GRA

N76-24403# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
MATERIALS RESEARCH IN SUPPORT OF SUPERCONDUCTING MACHINERY Semiannual Report, Apr. - Sep. 1975
R. P. Reed, J. G. Hust, M. B. Kasen, H. M. Ledbetter, and D. T. Read Jan. 1976 193 p refs
(ARPA Order 2569)
(PB-249041/5; NBSIR-75-828) Avail: NTIS HC $7.50 CSCL 11F

Results are reported of a six-month study, March through August 1975, on candidate materials for superconducting machinery. The results cover five areas-advanced composites, elastic properties, fatigue resistance and fracture toughness, magnetothermal conductivity, and thermal conductivity. Material properties were studied over the temperature range 4 to 300 K. Materials studied include: oxygen-free copper; copper-nickel alloys; a precipitation hardening copper alloy; invar; nickel-chromium-iron alloys; stainless steels; and the composite materials boron/aluminum, boron/epoxy, S-glass/epoxy, graphite/epoxy, and an organic-fiber/epoxy. GRA

N76-24404# West Virginia Dept. of Highways, Charleston.
EVALUATION OF STRUCTURAL STEEL COATINGS IN RELATION TO INDUSTRIAL ATMOSPHERIC CONDITIONS Final Report
John C. Moore and John R. OLeary Jan. 1975 78 p refs Sponsored by Fed. Highway Adm.
(PB-248604/1; WVDOH-23) Avail: NTIS HC $5.00 CSCL 11F

Project No. 23 has supplied added technical information on the durability of coatings applied to structural steel and exposed to the atmosphere plus chemical fumes from nearby industrial plants. The amount and nature of those chemical fumes were recorded and averages established for later use in the accelerated testing program. The coating system was designated failing when the degree of rusting of the steel had reached 10 percent on the ASTM D-610 pictorial standards. Sets of steel panels were blast-cleaned to commercial and to white metal and one set was pre-rusted and then cleaned by wire brushing. Paints were applied by brush and spray. Some one coat primed applied panels were exposed. The general types of available primers and some recommended top coats were included. The most important result of this project is the economy of blast-cleaning the structural steel to at least the commercial standard prior to coating. Vinyl top coats show some checking. Aluminum top coats are satisfactory. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-24405* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NON-FLAMMABLE ELASTOMERIC FIBER FROM A FLUORINATED ELASTOMER AND CONTAINING AN HALOGENATED FLAME RETARDANT Patent
John T. Howarth (Little (Arthur D.), Inc., Cambridge, Mass.), Suresh G. Sheth (Little (Arthur D.), Inc., Cambridge, Mass.), Kenneth R. Sidman (Little (Arthur D.), Inc., Cambridge, Mass.), and Arthur A. Massucco, inventors (to NASA) (Little (Arthur D.), Inc., Cambridge, Mass.) Issued 11 May 1976 56 p Filed 28 Jun. 1973 Supersedes N73-27501 (11 - 18, p 2167) Sponsored by NASA
(NASA-Case-MSC-14331-1; US-Patent-3,956,233; US-Patent-Appl-SN-374421; US-Patent-Class-260-45.7; US-Patent-Class-106-15FP; US-Patent-Class-260-33.8F; US-Patent-Class-260-92.1; US-Patent-Class-260-DIG.24; US-Patent-Class-526-1; US-Patent-Class-526-255) Avail: US Patent Office CSCL 11E

Flame retardant elastomeric compositions are described comprised of either spandex type polyurethane having incorporated into the polymer chain halogen containing polyols, conventional spandex type polyurethanes in physical admixture with flame retardant additives, or fluoroelastomeric resins in physical admixture with flame retardant additives. Methods are described for preparing fibers of the flame retardant elastomeric materials and articles of manufacture comprised of the flame retardant clastomeric materials and non elastic materials such as polybenzimidazoles, fiberglass, nylons, etc.
Official Gazette of the U.S. Patent Office

N76-24406*# Baylor Univ., Houston, Tex. Dept. of Dermatology.
EVALUATION OF TEXTILES PROPOSED FOR SPACECRAFT CREW APPAREL Final Report
W. Christopher Duncan [1976] 3 p
(Contract NAS9-14407)
(NASA-CR-147714) Avail: NTIS HC $3.50 CSCL 11E

Textiles proposed for spacecraft wearing apparel were tested for possible primary irritancy and allergenicity using guinea pigs and human subjects. The materials submitted for testing were: (1) blue, loosely knit fabric of a copolymer of chlorotrifluoroethylene and ethylene (CTFE), (2) a white fabric, 100% cotton double knit, treated with fire retardant Tetrakis (hydroxymethyl) phosphonium hydroxide/ammonia, and (3) a gold colored polyimide fabric. There were no adverse reactions to any of the fabrics. Author

N76-24407*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
RATE AND TIME DEPENDENT BEHAVIOR OF STRUCTURAL ADHESIVES Ph.D. Thesis
Michael P. Renieri, Carl T. Herakovich, and Halbert F. Brinson Apr. 1976 160 p refs
(Grant NGR-47-004-090)
(NASA-CR-118133; VPI-E-76-7) Avail: NTIS HC $6.75 CSCL 11A

Studies on two adhesives (Metlbond 1113 and 1113-2) identified as having applications in the bonding of composite materials are presented. Constitutive equations capable of describing changes in material behavior with strain rate are derived from various theoretical approaches. It is shown that certain unique relationships exist between these approaches. It is also shown that the constitutive equation derived from mechanical models can be used for creep and relaxation loading. A creep to failure phenomenon is shown to exist and is correlated with a delayed yield equation proposed by Crochet. Loading-unloading results are presented and are shown to correlate well with the proposed form of the loading-unloading equations for the modified Bingham model. Experimental results obtained for relaxation tests above and below the glass transition temperature are presented. It is shown that the adhesives obey the time-temperature superposition principle. Author

N76-24408*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLAME RETARDANT ELASTOMERIC COMPOSITIONS Patent Application

John T. Howarth (Little, (Arthur D.), Inc., Cambridge, Mass.), Arthur A. Massucco (Little, (Arthur D.), Inc., Cambridge, Mass.), Kenneth R. Sidman (Little, (Arthur D.), Inc., Cambridge, Mass.), and Suresh G. Sheth, inventors (to NASA) (Little, (Arthur D.), Inc., Cambridge, Mass.) Filed 13 Feb. 1976 46 p
(Contract NAS9-10424)
(NASA-Case-MSC-14331-2; US-Patent-Appl-SN-657907) Avail: NTIS HC $4.00 CSCL 11G

A patent application for an invention related to novel flame retardant compositions was presented. These elastomeric compositions are comprised of either spandex type polyurethane having incorporated into the polymer chain halogen containing polyols conventional spandex type polyurethanes in physical admixture with flame retardant additives or fluoroelastomeric resins in physical admixture with flame retardant additives. The invention is also related to the method of producing fibers and filaments from such compositions, and articles of manufacture incorporating such compositions. These materials may be used for extravehicular activities applications. NASA

N76-24409*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLAME RETARDANT ELASTOMERIC COMPOSITIONS
Patent Application
John T. Howarth (Little, Arthur D., Inc., Cambridge, Mass.), Arthur A. Massucco (Little, Arthur D., Inc., Cambridge, Mass.), Kenneth R. Sidman (Little, Arthur D., Inc., Cambridge, Mass.), and Suresh G. Sheth, inventors (to NASA) (Little, Arthur D., Inc., Cambridge, Mass.) Filed 13 Feb. 1976 46 p
(Contract NAS9-10424)
(NASA-Case-MSC-14331-3; US-Patent-Appl-SN-657998) Avail: NTIS HC $4.00 CSCL 11G
For abstract, see N76-24408.

N76-24410# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
ADHESION OF THE ROOM TEMPERATURE CURING ADHESIVES EC 2216 B/A AND AV 123 B ON THE CURED ADHESIVE PRIMER BR 227
J. Koetsier 25 Jun. 1974 8 p
(FOK-R-1791) Avail: NTIS HC $3.50

Metal-to-metal tensile shear and Bell peel test specimens were bonded and tested for use in Breguet-Atlantic aircraft. Although the adhesive system EC 2216 B/A and primer BR 227 gave the highest figures, the Araldite system AV 123 B with the same primer is also suitable for the intended purpose.
Author (ESA)

N76-24411# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Manufacturing Research and Product Development Dept.
METAL-TO-METAL ADHESIVE BONDED AIRCRAFT STRUCTURES
Jannes Koetsier Jun. 1975 16 p
(FOK-K-81) Avail: NTIS HC $3.50

A survey of the Fokker F27 'Friendship' and F28 'Fellowship' structures was made, and their structural approach discussed. Adhesive bonding of the fuselages, empennages and wings of the two aircrafts are detailed; service experience is mentioned. Materials (phenolic vinylic adhesive Redux 775 was mostly used) and processes are discussed, and production and quality control are outlined. ESA

N76-24412# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.
SILICON TUBES Final Report
Wolfgang Dietze Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 46 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-19) Avail: NTIS HC $4.00; ZLDI, Munich DM 9.70

Polycrystalline silicon tubes were prepared by chemical vapor deposition taking hydrogen-trichlorosilane mixtures at temperatures between 1000 and 1200 C. Silicon was deposited on correspondingly shaped surfaces of resistively heated graphite bodies and was separated afterwards. Silicon tubes, which can also be produced with a noncircular cross section, and boats prepared with them for supporting silicon slices may replace conventional quartz in semiconductor technology since polycrystalline silicon is considered superior to quartz with respect to purity and mechanical stability at high temperatures. Author (ESA)

N76-24413# Explosives Research and Development Establishment, Waltham Abbey (England).
THE STRENGTH OF THERMOPLASTIC MATERIALS. PART 2: A THEORY FOR MATERIAL STRENGTH AND ITS APPLICATION TO LIQUID STRESS CRACKING
B. J. MacNulty Apr. 1975 31 p refs
(ERDE-TR-205; BR50199) Avail: NTIS HC $4.00

The manner in which polymers, with phenylene groups in the main chain, break on contact with certain liquids, has led to the development of a tentative theory regarding the initiation mechanism of breaking of polymers when failing under stress alone and has resulted in a molecular theory of polymer strength which appears to predict the strength of the material from surface free energy and a consideration of molecular geometry. One result of the theory is the possible prediction of the maximum strength of a polymer from the chemical configuration of the monomer. Author (ESA)

N76-24414# Royal Aircraft Establishment, Farnborough (England).
EFFECTS OF DYES AND FINISHES ON THE WEATHERING OF NYLON TEXTILES
J. E. Swallow Jan. 1975 48 p refs
(RAE-TR-74179; BR46621) Avail: NTIS HC $4.00

The results of breaking strength tests of 2503 combinations of treatment and weathering exposure on nylon textiles were analyzed, principally by analysis of variance of ten factorial sets of data. Experiments were made with a range of dyestuffs, different amounts and mixtures of dyestuffs, various control treatments and a number of finishes. Correlations of strength losses with fading of dyestuffs are also reported. Author (ESA)

N76-24415# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF ADHEREND FLEXIBILITY ON ADHESIVE STRENGTH
J. H. Sewell Jun. 1975 22 p refs
(RAE-TR-75070; BR48176) Avail: NTIS HC $3.50

Relative strengths of super epoxy adhesive joints on metal and nonelastomeric polymer adherends having various flexibilities were measured using a modified cleavage test. The relationship found between joint strength and deformation of the adherend surface under load was substantially independent of the nature of the surface; high adhesive strengths were obtained only on rigid surfaces. Joint strengths were much more sensitive to changes in the flexibility of the adherend than to the same relative changes in adhesive flexibility obtained by heating or after immersion in water. Author (ESA)

N76-24416# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Concrete Lab.
INVESTIGATION OF NONMETALLIC WATERSTOPS. REPORT 9: FINAL REPORT OF EFFECT OF EXPOSURE
Billy J. Houston Jun. 1975 51 p refs
(AD-A012118; AEWES-TR-6-546-9) Avail: NTIS CSCL 13/5

Waterstops stressed, unstressed, and embedded were exposed at Treat Island, Maine, at St. Augustine, Florida, near St. Louis, Missouri, near New Orleans, Louisiana, and at Jackson, Mississippi, to determine the effect of various exposure conditions. The exposure conditions were as follows: (a) exposure to freezing and thawing in a marine environment, (b) exposure to wetting and drying in a warm marine environment, (c) outdoor exposure in a moderate climate, (d) indoor exposure (air without sunlight), (e) exposure in a weak solution of sodium and magnesium sulfate, (f) exposure to cold contaminated water, (g) exposure to cold fresh water, (h) exposure to warm contaminated water, and (i) exposure to warm fresh water. The samples were exposed during the period 1957-1959, and visual inspections of the exposed specimens were made periodically. GRA

N76-24417# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
DEVELOPMENT OF ARMY SYNTHETIC AUTOMOTIVE

ENGINE OILS FOR ARCTIC SERVICE Interim Report, Mar. 1970 - Jun. 1975
Sidney J. Lestz and Thomas C. Bowen Sep. 1975 42 p refs
(Contracts DAAD05-70-C-0250; DAAD02-73-C-0221)
(AD-A019113; AFLRL-73) Avail: NTIS CSCL 11/8

A three-phase program was conducted by the Army in order to obtain basic data required for the development of a new arctic engine oil (OEA) specification to replace the obsolete MIL-L-10295 sub-zero engine oil specification (OES). The first phase of the program involved the development and initial testing of improved arctic engine oils formulated using synthetic hydrocarbon or ester base stock materials. The second phase of the program involved field-testing of the improved oils, and the third phase covered definition of the performance requirements necessary for the new specification, MIL-L-46167 (OEA). This report covers the initial testing, development of the improved arctic engine oils, discussion relating to mixed fleet military test experience with the new lubricants, and laboratory testing of these new oils in standard oil test engines as well as in a specific military high-output diesel engine. Experience has shown these new synthetic lubricants are superior to the former mineral-based oils in ground-powered equipment and that they also function well as year-round hydraulic and power transmission lubricants. GRA

N76-24418# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
PERFORMANCE OF ARMY ARCTIC ENGINE OILS IN HYDRAULIC AND POWER TRANSMISSION FLUID SYSTEMS Interim Report, Jun. 1973 - Jun. 1975
Sidney J. Lestz, Paul D. Hopler, and Thomas C. Bowen Sep. 1975 33 p refs
(Contract DAAK02-73-C-0221)
(AD-A019524; AFLRL-74) Avail: NTIS CSCL 11/8

Development of the Army's new Arctic Engine Oil (OEA) Specification MIL-L-46167 required numerous laboratory and field engine evaluations as well as large scale laboratory and field testing of these new lubricants in military hydraulic and power transmission fluid systems (HPTF). Another report emphasizes the engine performance aspects of these synthetic oils, and now the current report points up and emphasizes the significant performance areas in military HPTF systems. The new oils function well as year-round lubricants in Army HPTF systems including: automatic and power-shift transmissions, power steering units, hydraulic winches, pumps, and mechanical and construction equipment hydraulic systems. It appears that the new synthetic arctic engine oils have significant potential military applications in HPTF systems outside arctic regions as well as inside the arctic. Problem areas are discussed and a recommendation is advanced for the development of a truly 'universal' HPTF. GRA

N76-24419# Weiler Research, Inc., Mountain View, Calif.
DOASIS: A COMPUTER PROGRAM FOR THE DEFORMATION PLASTICS, ORTHOTROPIC, AXISYMMETRIC (AND PLANE) SOLUTION OF INELASTIC SOLIDS. VOLUME 2: PRE- AND POST-PROCESSOR THEORETICAL AND PROGRAMMER'S MANUAL Final Report, Jun. 1974 - Oct. 1975
Frank C. Weiler Wright-Patterson AFB, Ohio AFML Oct. 1975 252 p refs
(Contract F33615-74-c-0148; AF Proj. 627A)
(AD-A018886; AFML-TR-75-37-Vol-2) Avail: NTIS CSCL 20/11

This report describes the pre- and post-processor computer programs MESHGN, TEMINT, PRSINT, ITEROG and CONTUR which are compatible with the finite element computer program DOASIS described in Volume I. The User Manuals for these programs are contained in Volume III. An overview of each of the programs contained in this report is presented in the appropriate sections describing the theory of each of the programs. The program MESHGN is used to generate a 2-dimensional finite element mesh for eventual use with the program DOASIS. The program TEMINT and PRSINT are used to translate 2-dimensional temperature fields and pressure fields, respectively, to the finite element mesh created by the program MESHGN. The program ITEROG is used to interrogate the stress and strain solution results obtained for the program DOASIS. The program CONTUR is used to make contour plots, cut-section plots and exaggerated displacement plots of the solution results obtained from the program DOASIS. GRA

N76-24420# Weiler Research, Inc., Mountain View, Calif.
DOASIS: A COMPUTER CODE FOR THE DEFORMATION PLASTIC, ORTHOTROPIC, AXISYMMETRIC (AND PLANE) SOLUTION OF INELASTIC SOLIDS. VOLUME 3: USER'S MANUAL Final Report, Jun. 1974 - Jul. 1975
Frank C. Weiler Oct. 1975 73 p
(Contract F33615-74-C-0148)
(AD-A018861; AFML-TR-75-37-Vol-3) Avail: NTIS CSCL 20/11

The computer program input data and formats are described for the pre-processor computer programs MESHGN, TEMINT and PRSINT, for the finite element computer program DOASIS, and for the post-processor computer programs ITEROG and CONTUR. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-24421# Messer Griesheim G.m.b.H., Frankfurt am Main (West Germany). Sparte Industriegase.
PRODUCTION AND TRANSPORT OF HYDROGEN SLUSH Final Report
Rolf Schraewer Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 97 p refs In GERMAN; ENGLISH summary
Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-22) Avail: NTIS HC $5.00; ZLDI, Munich DM 20.40

Hydrogen slush, a homogeneous mixture of liquid and solid hydrogen, was discontinuously produced using vacuum pumps. Efforts with regard to a continuous production method led to the nozzle expansion method in which the amount and the fine granulation of the ice could be increased. A nuclear density measuring sensor was developed in which the weakening of the beta-radiator represents a unit of measurement for the ice portion and therefore of the slush quality. Transport tests with fresh and artificially aged slush revealed that on using small bore pipings it was possible to transport only artificially aged slush.
Author (ESA)

N76-24422# Institut Franco-Allemand de Recherches, St. Louis (France).
EFFECTS OF ELECTROMAGNETIC RADIOFREQUENT EMISSIONS PRODUCED BY DETONATING CHEMICAL EXPLOSIVES. PART 1: EXPERIMENTAL RESULTS [RADIOFREQUENTE ELEKTROMAGNETISCHE STRAHLUNGSEFFEKTE DETONIERENDER CHEMISCHER SPRENGLADUNGEN. TEIL 1: EXPERIMENTELLE ERGEBNISSE]
B. Koch, H. Haensel, R. Kohlmann, G. Horny, and M. Koenig 27 Feb. 1974 128 p refs In GERMAN
(Contract T-0260-12630-11012)
(ISL-5/74) Avail: NTIS HC $6.00

Energy and maximum performance of radiofrequent electromagnetic radiation impulses, produced by the detonation of shells of different caliber and of explosion simulators of various sizes and wall materials, were measured. The recordings were made simultaneously with five calibrated receiver amplifiers in the 2.8 m and 40 cm wavelength region in the far field area of the radiation sources. Conclusions on the relationship between radiation energy and emission delay, detection distance, and overthermal nature of the radiation effects are summarized. In annexes a definition of the far field energy conservation on transfer of a block impulse across a lossfree threshold (passive integration), and an active integrator are discussed. ESA

N76-24423# Institut Franco-Allemand de Recherches, St. Louis (France).
SPECTROSCOPIC TEMPERATURE MEASUREMENT NEAR THE MOUTH OF A RIFLE [SPECTROSKOPISCHE TEMPE-

RATURBESTIMMUNG IM UNMITTELBAREN MUENDUNGSBEREICH EINES GEWEHRES]
G. Klingenberg, H. Mach, and U. Werner 20 Feb. 1975 44 p refs In GERMAN Prepared jointly with Arbeitsgruppe fuer Ballistische Forsch.
(ISL-R-104/75; ABF-4/74) Avail: NTIS HC $4.00

The temperature in the strong absorbing cloud surrounding the luminous propellant gas near the mouth of a rifle was measured as a function of time using emission and absorption spectroscopic techniques. The strong absorption in the cold part of the gas cloud was accounted for by determining the transversal distribution of the optical thickness. The average maximum gas temperature to microsec after the projectile leaves the mouth was found to be 1645 K. This result is in good agreement with the temperature measured in the downstream flow core immediately behind the expansion zone. ESA

N76-24424# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
REACTIONS OF NITROGUANIDINE WITH HYDRAZINE. ATTEMPTS TO PREPARE NITROAMINO, GUANIDINE, AMINO, DIAMINO, AND TRIAMINOGUANIDINE NITRATE [REAKTIONEN VON NITROGUANIDIN MIT HYDRAZIN. VERSUCHE ZUR DARSTELLUNG VON NITROAMINOGUANIDIN AMINO-, DIAMINO- UND TRIAMINOGUANIDINNITRAT]
W. Engel 30 Oct. 1974 35 p refs In GERMAN
(ICT-3/74) Avail: NTIS HC $4.00

The synthesis of nitroaminoguanidine and the nitrates of amino-, diamino- and triaminoguanidine in water and ethanol producing the yellow aminoguanidine salt of 1.6-dinitrobiguanidine was studied. The reaction of nitroguanidine with hydrazine and hydrazine nitrates produces, under different conditions, nitroaminoguanidine, mono-, di-, and triaminoguanidine nitrate. The reaction is suitable for the production of nitroaminoguanidine and diaminoguanidine nitrate on a preparative scale. Aminoguanidine nitrate can be prepared from the reaction of nitroguanidine with hydrazine and ammonium nitrate or from the reaction of nitroguanidine with hydrazine nitrate in an ammonia solution. ESA

N76-24425# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
INVESTIGATIONS ON THE SYNTHESIS OF POLYISOPROPENYL NITRATE [UNTERSUCHUNGEN UEBER DIE DARSTELLUNG VON POLYISOPROPENYLNITRAT]
K. M. Bucerius 15 Nov. 1974 23 p refs In GERMAN
(ICT-4/74) Avail: NTIS HC $3.50

The synthesis of polyisopropenyl nitrate as a potentially new stable polymeric explosive is described. A small survey of the literature is given and the polymerization of isopropenyl acetate is discussed. The synthesis of polyisopropenyl alcohol from polyisopropenyl acetate is dealt with and the nitration of the alcohol to the nitrate is presented. The stabilization of polyisopropenyl nitrate is discussed. ESA

N76-24426# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
INVESTIGATION ON NEW STABILIZERS FOR CELLULOSE NITRATE. PART 2: AMINES, AMIDES, AZOCOMPOUNDS [UNTERSUCHUNG VON NEUEN STABILISATOREN FUER NITROCELLULOSE. TEIL 2: AMINE, SAEUREAMIDE, AZOVERBINDUNGEN]
R. Hansen 31 Dec. 1974 87 p refs In GERMAN
(ICT-8/74) Avail: NTIS HC $5.00

The stabilizing effect on cellulose nitrate of amine-, amide- and azo compounds was investigated in order to increase the lifetime of double base solid propellants and propellant powders. As a stability measure the permanent weight loss at 90 deg was used. It was shown that the stability values of cellulose nitrate obtained with diphenylamine or nitro diphenylamine could be improved using other compounds. ESA

N76-24427# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
SOLID PROPELLANT COMBUSTION THEORIES TAKING EXPERIMENTAL MEASUREMENT RESULTS INTO ACCOUNT [ABBRANDTHEORIEN VON FESTTREIBSTOFFEN UNTER BERUECKSICHTIGUNG PRAKTISCHER MESSERGEBNISSE]
H. Pfoertner 31 Dec. 1974 35 p refs In GERMAN
(ICT-9/74) Avail: NTIS HC $4.00

The combustion of solid rocket propellants is discussed in general and various combustion theories, describing the combustion rate as a function of pressure and of initial temperature, are described. The theory was compared with experimental results. The significance of combustion modifying additives to double base propellants, with special emphasis on the equilibrium pressure in a rocket combustion chamber, is dealt with. ESA

N76-24428# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
STATE OF TECHNOLOGY IN THE FIELD OF HIGH ENERGY PROPULSION SYSTEMS [STAND DER TECHNIK AUF DEM GEBIET HOCHENERGETISCHER ANTRIEBSSYSTEME]
Roger Lo 1 Jan. 1975 44 p In GERMAN
(DLR-IB-456-75/1) Avail: NTIS HC $4.00

A survey is presented of the latest developments in the field of high energy propellants combinations. For solid propellants, all problems have been solved. Propellants with metal additions including beryllium are available and can be used at least for nonspace purposes. For liquid diergolic propellants, hydrogen/oxygen will be used largely in high pressure propulsion systems. The manufacturing of metal containing fuels in suspension form has been resolved. The only promising liquid combination with fluorine oxidizer is the system F2O/B2H6. The first hybrid system to be probably used for space applications is FLOX/HFX. Triergolic research has been suspended. Beryllium is no longer considered as a fuel for space applications. ESA

N76-24429# Naval Ship Research and Development Center, Annapolis, Md. Materials Dept.
NAVY FUEL INTERACTIONS WITH ADDITIVES. PHASE 1: AN INVESTIGATION OF SIDE EFFECTS FROM A COMMERCIAL BIOCIDE
K. V. Nagy and D. E. Pokoj Dec. 1975 25 p refs
(AD-A018966; MAT-74-47) Avail: NTIS CSCL 21/4

Potentially detrimental side effects of adding an organoboron type of biocide to Navy distillate fuels have been investigated. There were no significant differences in such properties as interfacial tension, demulsibility, accelerated storage stability, acidity (neutralization number), and flash point temperature as a result of adding the biocide, when these properties were measured immediately after blending and also after 16 weeks of storage at 75F (24C) or at 110F (43C). Appreciable portions of biocide were leached out of the fuel by water present. No consistent major effects on the operation of a filter/separator were evident, but a reduction of the water content of the effluent fuel was associated with the presence of the biocide. GRA

N76-24430# Ballistic Research Labs., Aberdeen Proving Ground, Md.
QUANTUM MECHANICAL STUDIES ON CHEMICAL REACTIVITY AND BALLISTIC CHEMISTRY. 6: LITERATURE REVIEW ON THE RELATIONSHIP BETWEEN STRUCTURE AND REACTIVITY IN ISOMERIC TETRAZOLE DERIVATIVES
Michael A. Schroeder Nov. 1975 29 p refs
(DA Proj. 1W1-61102-AH-53)
(AD-A018652; BRL-1848) Avail: NTIS CSCL 20/10

As part of a program of molecular orbital calculations on the chemistry of compounds of explosive and propellant interest, a review and comparison of published reactivity differences among isomeric 1- and 2-substituted tetrazole derivatives are given. It is found that 1-substituted-5-tetrazolyl groups appear to be considerably more electron-withdrawing than do the isomeric 2-substituted-5-tetrazolyl groups. The relative reactivities of substituents at positions 1 and 2 of isomeric pairs of tetrazole derivatives are also reviewed, but it is harder to distinguish any systematic trend for the N-substituents. Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-24431# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
NITROGEN GAS GENERATOR DEVELOPMENT: CLGP Final Report, 25 Apr. - 25 Oct. 1975
W. J. Lawrence, J. C. Trowbridge, and D. R. Matthews 25 Oct. 1975 55 p refs
(Contract DAAH01-75-C-0801)
(AD-A019444; CSD-2559-FR) Avail: NTIS CSCL 14/2

A 5-month program was conducted to develop a solid fueled nitrogen gas generating system for use in high acceleration environments. Tests were performed at temperatures from -40F to 165F to determine the ignition and ballistic characteristics, establish the gas generation efficiency, and confirm the structural integrity. Six conformance tests were conducted at three temperature levels. The basic design is capable of meeting all of the system requirements with the exception of the delivered gas temperature which was higher than desired. Recommendations for correcting this deficiency and other areas requiring technology development are discussed. The design of an alternate nitrogen gas generator system to replace a high pressure helium storage bottle is presented. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N76-24432 British Library Lending Div., Boston Spa (England).
ADAPTIVE DIFFERENTIAL PULSE CODE MODULATION FOR PICTURE CODING
Rainer Lueder [1975] 17 p refs Transl. into ENGLISH from Arch. Elektronik Uebertragungstech. (AEUE) (Stuttgart), vol. 29, no. 6, 1975 p 251-256
(BLL-Trans-3335-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Differential Pulse Code Modulation (DPCM) with previous-element prediction is extended to Adaptive Differential Pulse Code Modulation (ADPCM) by a switched quantizer. The ADPCM coder analyzes the video signal and classifies the picture elements in sets of various structures (areas, details etc.). A different quantization is used for every set. As the adaptation depends on the previous code words, ADPCM enables a code with fixed word length and constant bit rate. The properties of this adaptive picture coding process with 3 bit/picture element were experimentally studied and compared with well known DPCM. Author

N76-24433*# Pennsylvania Univ., Philadelphia. Valley Forge Research Center.
RESEARCH IN LARGE ADAPTIVE ANTENNA ARRAYS Final Report
Raymond S. Berkowitz and Tomislav Dzekov Mar. 1976 104 p refs
(Grant NsG-5064)
(NASA-CR-148135; VFRC-86) Avail: NTIS HC $5.50 CSCL 20N

The feasibility of microwave holographic imaging of targets near the earth using a large random conformal array on the earth's surface and illumination by a CW source on a geostationary satellite is investigated. A geometrical formulation for the illuminator-target-array relationship is applied to the calculation of signal levels resulting from L-band illumination supplied by a satellite similar to ATS-6. The relations between direct and reflected signals are analyzed and the composite resultant signal seen at each antenna element is described. Processing techniques for developing directional beam formation as well as SNR enhancement are developed. The angular resolution and focusing characteristics of a large array covering an approximately circular area on the ground are determined. The necessary relations are developed between the achievable SNR and the size and number of elements in the array. Numerical results are presented for possible air traffic surveillance system. Finally, a simple phase correlation experiment is defined that can establish how large an array may be constructed. Author

N76-24434# Alaska Univ., Fairbanks. Geophysical Inst.
EFFECTS OF HIGH LATITUDE GEOPHYSICAL EVENTS IN THE AERONAUTICAL RADIO FREQUENCY BANDS Final Report
Howard F. Bates and T. Neil Davis Jan. 1976 23 p refs
(Contract DOT-FA74WA-3356)
(AD-A023011/0; FAA-RD-75-198) Avail: NTIS HC $3.50 CSCL 17/2

A plan is formulated to search, extract, interpret, correlate, and display solar/geophysical disturbance description and impact on radio services in various aeronautical-service frequency bands from 10 KHz to 300 GHz. It qualitatively describes the sort of a data available and some of the possible ways the data can be presented. A description of radio effects caused by various phenomena is compiled from past work done primarily by Geophysical Institute personnel in the frequency range 10 KHz to 1.5 GHz as illustrative examples. These results are presented in tables that illustrate both the temporal and frequency effects of each of the geophysical phenomena considered. It is concluded that a more thorough study of the literature could provide the material necessary for a practical high-altitude communications handbook for airmen. Author

N76-24435# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AIRCRAFT COMMUNICATIONS INTERFERENCE TESTS Final Report, Apr. - May 1975
Jack Bernstein Mar. 1976 19 p ref
(AD-A022954/2; FAA-NA-75-56) Avail: NTIS HC $3.50 CSCL 17/2

Tests were conducted to determine aircraft VHF antenna isolation and VHF receiver response. The tests show that isolation depends on the physical positioning of the antennas on the airframe and that existing isolation can realistically cause interference or quieting between transceivers even though they are operating at different frequencies up to 4 MHz apart. It was also found that transceiver design affects the rejection of undesired received signals. It was recommended that maximum isolation be maintained between aircraft antennas, receiver design be optimized for rejection of undesired signals, and cockpit communications discipline be used. Author

N76-24436*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SAMPLING VIDEO COMPRESSION SYSTEM Patent Application
Yutaka Matsumoto and Henry Lum, Jr., inventors (to NASA) Filed 27 May 1976 14 p
(NASA-Case-ARC-10984-1; US-Patent-Appl-SN-690815) Avail: NTIS HC $3.50 CSCL 17B

A picture transmission system is described for transmitting a video signal of compressed bandwidth in which the transmitting station is provided with circuitry for dividing a picture to be transmitted into blocks containing a checkerboard pattern of picture elements and regularly sampling video signals along corresponding diagonal rows of picture elements in the respective blocks. A transmitter responsive to the output of the sampling circuitry for transmitting the sampled video signals of one frame at a reduced bandwidth over a communication channel is provided along with a receiving station with a frame memory for temporarily storing transmitted video signals of one frame, and circuitry for playing back the video signals of one frame at the original high bandwidth frequency. NASA

N76-24437# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
DESIGN OF MAN-MACHINE COMMUNICATION SYSTEMS: BASIC HUMAN FACTORS, DEMANDS, AND RECOMMENDATIONS
R. Zimmermann Apr. 1975 35 p refs In GERMAN

(KFK-PDV-38) Avail: ERDA Depository Libraries HC $4.75
This paper shows some fundamentals of man--machine communication and deduces demands and recommendations for the design of communication systems. The main points are the directives for the design of optical display systems with details for visual perception and resolution, luminance and contrast, as well as discernibility and coding of displayed information. The most important rules and recommendations for acoustic information systems, control devices and for design of consoles are also given. Author (ERA)

N76-24438# Standard Electrik Lorenz A.G., Stuttgart (West Germany). Erzeugnisbereich Funk und Navigation.
ECONOMIC APPLICATIONS OF SATELLITES FOR DIGITAL DATA TRANSMISSION IN THE FEDERAL REPUBLIC OF GERMANY Final Report [WIRTSCHAFTLICHE EINSATZMOEGLICHKEITEN VON SATELLITEN ZUR DIGITALEN NACHRICHTENUEBERTRAGUNG IN DER BRD]
Dietrich Becker, Gerhard Brust, Peter F. Hein, Anders Ljungstroem, Klaus Nocon, and Rolf Stiefel Bonn Bundesmin. fuer Forsch. u. Technol. Sep. 1975 201 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. (BMFT-FB-T-75-15) Avail: NTIS HC $7.75; ZLDI, Munich DM 42,25

The economic feasibility of a domestic satellite communications system for digital data transmission within Germany was investigated. The bit rate of long distance telephony traffic during the busy period was estimated. Required bit rates for telex, data, and TV traffic were estimated for the busy period. The digitalizing of TV signals is discussed. The capacity of a satellite in orbit was calculated. Balances for up and down links were considered. Mass and power requirements of the space segment were determined. A cost analysis was carried out. The conclusion is that satellites cannot be used economically for transmission of the national telex ad data traffic in Germany. ESA

N76-24439# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
INTEGRAL REPRESENTATIONS AND SAMPLING THEOREMS OF PERIODIC FUNCTIONS AND THEIR HILBERT TRANSFORMS [INTEGRALDARSTELLUNGEN UND ABTASTTHEOREME PERIODISCHER FUNKTIONEN UND DEREN HILBERT-TRANSFORMIERTER]
Hermann Kremer Sep. 1973 19 p refs In GERMAN
(IND-FB-63) Avail: NTIS HC $3.50

Integral representations are given for periodic functions resulting from their Fourier series, and these are used to produce integral representations for their Hilbert transforms. Sampling theorems are acquired for the functions themselves as well as for their Hilbert transforms by limiting to band-limited periodic functions. ESA

N76-24440# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
INVESTIGATION OF REDUNDANCY REDUCING CODING OF SPEECH SIGNALS IN THE FOURIER- AND WALSH DOMAIN [UNTERSUCHUNG REDUNDANZVERMINDERNDER CODIERUNGEN VON SPRACHSIGNALEN IM FOURIER- UND WALSH-BEREICH]
Paul Herger Jan. 1974 23 p refs In GERMAN
(IND-FB-64) Avail: NTIS HC $3.50

The redundancy reduction of speech signals, using linear transformation was investigated. The data reduction was obtained by quantization and coding of the spectral coefficients. The resulting mean quadratic error was compared with the quantization errors of DCM transmission. Real time analysis and synthesis of speech signals was realized for the Walsh transformation. Speech samples of the transformation vocoder are compared with samples from a PCM transmission link with adjustable bit rate. ESA

N76-24441# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
GREAT-CIRCLE DEVIATION OF SHORT WAVE SIGNALS RESULTING FROM SCATTERING AND REFLECTION BY IONOSPHERIC IRREGULARITIES. EFFECT ON RADIO NAVIGATION AND COMMUNICATION, EXEMPLIFIED BY TRANSEQUATORIAL SHORT WAVE PROPAGATION [GROSSKREISABWEICHUNGEN VON KURZWELLENSIGNALEN DURCH STREUUNG UND REFLEXION AN IRREGULARITAETEN IN DER IONOSPHAERE. DER EINFLUSS AUF FUNKNAVIGATION UND FUNKKOMMUNIKATION, GEZEIGT AM BEISPIEL DER TRANSAEQUATORIALEN KURZWELLENAUSBREITUNG]
J. Roettger Bonn DOKZENTBw 1975 84 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung (BMVg-FBWT-75-9) Avail: NTIS HC $5.00; DOKZENTBw DM 30

Characteristic propagation conditions on a transequatorial radio path which are observed by a bistatic HF radar system, measuring the propagation time, amplitude, and azimuth angle of radio signals are reported. Typical observations are presented which are caused by equatorial spread-F, i.e., irregularities in the equatorial ionosphere. The methods of investigation may also be applied to HF radio systems in middle and polar latitudes. The results obtained point out that an essential influence on the reliability of trans-horizon radar systems has to be expected if the propagation path approaches the equatorial zone. It is proved by means of observations of non-great-circle propagation that large scale wavelike structures with eastbound velocity components occur in the equatorial ionosphere which may be incorrectly detected as moving real radar targets. The reflection (radar) cross section of the ionospheric irregularities was calculated and compared with measurements. Based on the digital data, the mean field strength and the fading spectrum of the amplitude fluctuation were deduced. Some consequences are drawn which can be used to improve the forecast of the influence of ionospheric irregularities on radio communication and radio navigation.
Author (ESA)

N76-24442# Florence Univ. (Italy). Ist. di Elettronica.
DEVELOPMENT AND APPLICATIONS OF A METHOD FOR PULSE RESPONSE DETERMINATION IN DISCRETE LINEAR SYSTEMS [REALIZZAZIONE E APPLICAZIONI DI UN METODO PER LA DETERMINAZIONE DELLA RISPOSTA IMPULSIVA DI SISTEMI LINEARI DISCRETI]
E. DalleMese (Pisa Univ.) and D. Giuli 1974 40 p refs In ITALIAN; ENGLISH summary Presented at the Meeting of the Gruppo Telecomun. e Teoria dell'Inform., Naples, 16-18 Oct. 1974
(Contract CNR-74.00510.07)
(R-1-74) Avail: NTIS HC $4.00

Real-time implementation of a recursive procedure for exact estimation of impulse-response of discrete time linear systems is analyzed, when PRBS's are used as probing inputs. Applications to all-range decoder in radar with binary phase-coded modulation are also examined. Author (ESA)

N76-24443# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
TARGET TRACKING IN DISTURBED ZONES WITH KALMAN FILTERS FOR ELECTRONIC RADAR [ZUR ZIELVERFOLGUNG IN STOERGEBIETEN MIT KALMAN FILTERN BEI ELEKTRONISCHEM RADAR]
G. VanKeuk Sep. 1975 51 p refs In GERMAN; ENGLISH summary
(Rept-232) Avail: NTIS HC $4.50

In computer aided target tracking track loss cannot be avoided if there is a high false alarm rate. The problem is analyzed, different strategies are compared. A new method which decreases the probability of track loss is proposed. It is demonstrated and analyzed that track loss can be reduced considerably by increasing the sampling frequency. A simple sequential decision algorithm to detect false tracks in dense clutter environments is proposed.
Author (ESA)

N76-24444# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany).
WAVE MODE TRANSDUCER FOR EXCITATION OF THE H01 WAVE FOR 92-140 GHz. ITS FABRICATION, AND A TRANSMISSION PROPERTY TEST METHOD [EIN WELLENTYPWANDLER ZUR ERREGUNG DER H01-WELLE FUER 92-140 GHz. SEINE FERTIGUNG UND EIN MESSVERFAHREN ZU DEN UEBERTRAGUNGSEIGENSCHAFTEN]
Rudolf Loeffler and Bernhard Enning 1974 55 p refs In GERMAN Sponsored by Fernmeldetech. Zentralamt Darmstadt

(TB-175) Avail: NTIS HC $4.50

A survey is presented of broadband excitation methods of the H01 wave. The construction of a double helix wave mode transducer, based on the G-Marie principle, as well as of a disk filter, is described for the F band (92 to 140 GHz). This equipment is to be used for investigation of higher frequency applications of hollow cable waveguides (above 80 GHz). A test method allowing the determination of the scattering matrix of the wave mode transducer is discussed. A modification of the method according to B. Strebel is used. ESA

N76-24445# Thomson-CSF, Velizy (France). Div. des Faisceaux Hertziens.

TRANSPONDER CHARACTERISTICS OF A BROADCASTING SATELLITE. COMPLEMENTARY STUDY FOR FM-FM MODULATION CONVERSION ONBOARD A SATELLITE Final Report [ETUDE DES CARACTERISTIQUES DU REPONDEUR D'UN SATELLITE DE RADIODIFFUSION. COMPLEMENT D'ETUDE SUR L'INTERET DE LA CONVERSION DE MODULATION FM-FM A BORD DU SATELLITE]

Dec. 1975 145 p refs In FRENCH

(Contract ESRO-SC/25-HQ)

(VB/SD-117; ESA-CR(P)-787) Avail: NTIS HC $6.00

Possibilities of improving the FM uplink spectrum utilization of broadcasting satellites were investigated for a transparent transponder. The following methods were envisaged: FM-FM conversion onboard the satellite and frequency reutilization. It was found that a transponder with FM-FM modulation conversion can effectively contribute to improved uplink spectrum utilization. A bandwidth reduction of 17 MHz on the uplink can be obtained, as compared to 27 MHz downlink bandwidth. Frequency reutilization can in principle lead to a better spectrum utilization. ESA

N76-24446# Etudes Techniques et Constructions Aerospatiales, Charleroi (Belgium).

STUDY OF 12 GHz SATELLITE BROADCAST RECEIVER

A. Dumont 1 Aug. 1975 90 p refs

(Contract ESRO-SC/59-HQ)

(EC/AD/SM-LAB-75.110; ESA-CR(P)-782) Avail: NTIS HC $5.00

A compatible technical and economical model for direct broadcast TV receivers at 12 GHz is discussed. A limited number of types was envisaged for a production model. Basic solutions were retained, and their tradeoff are described: double superheterodyne with main IF at 1.2 GHz, wideband, tuning on second LO, directly applicable to FM community distribution, single superheterodyne, low IF, first LD frequency in band, tuning of SHF amplifier, and double superheterodyne with direct mixed output, main IF at 400 MHz. ESA

N76-24447# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

SIGNAL DELAY CALCULATIONS FOR LINE SYNCHRONIZATION OF SATELLITE PICTURES [LAUFZEITBERECHNUNG VON SIGNALEN FUER DIE ZEILENSYNCHRONISATION VON SATELLITENBILDERN]

M. C. Eckstein and E. F. Jochim 13 Jan. 1976 24 p In GERMAN

(DLR-IB-552-75/17) Avail: NTIS HC $3.50

Two consecutive programs, RANGE and INTPOL, are described for calculating signal delay satellite-earth for picture line synchronization. The RANGE program calculates for discreet time intervals the distance between satellite and a given station as well as the related signal delay and the elevation during the visibility period. The INTPOL program interpolates the delay time for desired points in time during the visibility period. ESA

N76-24448# Texas Instruments, Inc., Dallas.

SPEAKER VERIFICATION 2 Final Report, Apr. 1973 - Apr. 1975

George R. Doddington and Barbara M. Hydrick Nov. 1975 111 p

(Contract F30602-73-C-0259; AF Proj. 4027)

(AD-A018901; RADC-TR-75-274) Avail: NTIS CSCL 17/2

The objective of this report, which covers further development of speaker verification technology, is the development of an operational capability for entry control via speaker verification. Practical techniques have been developed for adapting speech reference minimizing speaker reference storage requirements, and enrolling users. Experiments on the verification of speakers in free text were also conducted. GRA

N76-24449# RAND Corp., Santa Monica, Calif.

A NEW TOOL FOR FAST DIGITAL CORRELATION Interim Report

John Lindsey and Irving S. Reed Sep. 1975 31 p refs

(Contract F44620-73-C-0011)

(AD-A018782; R-1594-PR) Avail: NTIS CSCL 17/2

Many modern communication and radar systems in the USAF transmit and receive sophisticated waveforms. To detect these waveforms in the presence of noise, the received waveform must be correlated with all the transmitted waveforms that may have been sent. The large number of these waveforms and their length in symbols often precludes the use of analogue correlation and necessitates the use of digital correlation. This study of transforms over finite fields opens the possibility of discovering new fast digital correlation techniques for communication and radar problems. It is felt that such techniques will enhance fast Fourier transform methods used presently to yield fast digital convolution. Author (GRA)

N76-24450# Naval Underwater Systems Center, New London, Conn.

PROJECT SANGUINE Quarterly Technical Summary Report, 1 Oct. - 31 Dec. 1974

2 Dec. 1975 26 p refs

(NUSC Proj. A-590-00)

(AD-A018994; NUSC-TR-5237) Avail: NTIS CSCL 17/2

The work reported includes field measurements concerned with extremely low frequency earth conductivity at 15 sites in the western United States. GRA

N76-24451# Naval Postgraduate School, Monterey, Calif.

ANALYSIS OF THE PARAMETERS REQUIRED FOR PERFORMANCE MONITORING AND ASSESSMENT OF MILITARY COMMUNICATIONS SYSTEMS BY MILITARY TECHNICAL CONTROLLERS M.S. Thesis

Roy Martin Shoemaker Dec. 1975 168 p refs

(AD-A019377) Avail: NTIS CSCL 17/2

The purpose of the thesis was the determination and analysis of the specific parameters required for performance monitoring and assessment of military communications systems by military technical controllers. Theses parameters if measured and analyzed correctly will allow military technical controllers to anticipate difficulties and permit appropriate corrective action before actual failure of the communications system. The three areas from which these parameters are derived from are: level, noise and distortion. The unsuitability of current instruments to provide quality assurance of the numerous circuits appearing at technical control facilities is discussed and a dedicated, task oriented, combination measuring set is evaluated as to its ability to measure the parameters that have been determined. GRA

N76-24452# Naval Intelligence Support Center, Washington, D.C. Translation Div.

ON DETERMINING THE RANGE OF A HYDROACOUSTIC COMMUNICATIONS CHANNEL

E. I. Chvertkin 1 Dec. 1975 8 p refs Transl. into ENGLISH from Tr. Gidrometeorologicheskii Inst. (Leningrad), no. 36, 1971 p 127-129

(AD-A019226; NISC-Trans-3730) Avail: NTIS CSCL 17/2

Calculations are presented for the range of an underwater sound communications channel. GRA

N76-24453# CNR, Inc., Newton Upper Falls, Mass.

ADAPTIVE CHANNEL MEASUREMENT STUDY Final Technical Report, Jun. 1974 - Feb. 1975

Phillip A. Bello, Charles J. Boardman, and Louis E. Jankauskas Griffiss AFB, N. Y. RADC Sep. 1975 332 p refs

(Contract F30602-74-C-0283)

(AD-A018764; RADC-TR-75-243) Avail: NTIS CSCL 17/2

The study is concerned with performance assessment, fault location, and degradation trending for PCM/TDM-FM digital transmission over DCS microwave relay systems. The reported

work complements and integrates previous work to provide a comprehensive new systems - theoretic approach to channel quality monitoring called the parametric approach. In this approach, three basic quality measurement units are defined - the TQU, MQU, and RQU - which measure channel parameters at the transmitter output, receiver input, and receiver output interfaces. The potentialities of adaptive channel parameter measurement techniques are investigated with the aid of computer simulation and analysis. Consideration was given to the use of different adaptation algorithms, multipath fading, the accuracy of parameter measurement, adaptation time constants, and the estimation of error rates from the measured channel parameters. For the channel disturbance model chosen, the calculations indicate that the adaptive channel parameter measurement technique represents a viable basis for performance assessment. GRA

N76-24454# Army Electronics Command, Fort Monmouth, N.J. Communications/Automatic Data Processing Lab.
SELECTED VHF CHANNEL SIMULATOR TRANSMISSION PHENOMENON
George Krause Nov. 1975 30 p refs
(DA Proj. 1S7-62701-AH-92)
(AD-A019006; ECOM-4372) Avail: NTIS CSCL 17/2

A Tactical Channel Simulator system using a tapped delay line technique was used to record, on magnetic tape, the perturbations that the VHF media imposes on R.F. transmission. The outputs from the simulator's delay line taps were plotted on strip charts to show dispersions recorded by its prober-analyzer sub-system during on-the-air VHF channel tests. Characteristic traces of multipath caused by off-path reflections from both stationary (terrain) and moving (aircraft) objects were observed. Binary error occurrences were correlated with dispersions due to aircraft and suspected lightning activity. GRA

N76-24455# Army Electronics Command, Fort Monmouth, N.J. Communications/ADP Lab.
ROTOR EFFECTS ON L-BAND SIGNALS RECEIVED BY HELICOPTER ANTENNAS. PART 3: MEASUREMENTS OF THE AMPLITUDE AND PHASE DISTORTIONS OF CW SIGNALS Final Experimental Report, CY 1973
C. M. DeSantis and F. Schwering Dec. 1975 37 p refs
(DA Proj. 1T1-61102-B-31A)
(AD-A019506; ECOM-4383-Pt-3) Avail: NTIS CSCL 17/7

An experimental study of rotor-blade-induced distortions of L-band signals has been carried out to verify the results of a previous theoretical investigation. These signals were received by helicopter antennas mounted on the cabin roof below the rotor. To verify the theoretical findings, the effects of such distortions on horizontally and vertically polarized incident signals were measured for several directions of incidence. The results of both the theory and experiments are in excellent agreement. GRA

N76-24456# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
A VARIATIONAL ANALYSIS OF THE REFLECTION OF SURFACE WAVES BY ARRAYS OF REFLECTING STRIPS
B. K. Sinha and H. F. Tiersten Nov. 1975 43 p refs
(Contract N00014-67-A-0117-0007; NR Proj. 017-504)
(AD-A018732; TR-15) Avail: NTIS CSCL 20/14

A system of approximate surface wave equations and edge conditions in one scaler variable is derived from Hamilton's principle for linear piezoelectric media by assuming suitable depth behavior and integrating with respect to depth. The assumed behavior with depth is determined from the known surface wave solutions of the three-dimensional equations for both the plated and uplated substrate. The influence of the inertia, stiffness and electrical shorting of the film is included in the analysis. The approximate equations are expressed in terms of the known fundamental material constants and no measurement of model parameters is required. Bulk wave scattering is not considered. The approximate equations, which admit of a transmission line representation, are applied in the analysis of surface wave reflection by both uniformly and nonuniformly spaced arrays of reflecting strips plated on various substrates. Among other things, the calculated reflection curves indicate a slight asymmetry for heavier film materials on account of the dispersion caused by the strips. Although this effect has been observed experimentally, it has not been reproduced by other analytical models.
Author (GRA)

N76-24457# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
RADIATION FROM A LINE SOURCE CARRYING A TRAVELING WAVE IN A MAGNETOPLASMA Interim Report
David C. PridmoreBrown 1 Dec. 1975 30 p refs
(Contract F04701-75-C-0076)
(AD-A019148; TR-0076(6260-40)-1; SAMSO-TR-75-287)
Avail: NTIS CSCL 20/14

A modulated beam of charged particles is represented as an infinite line antenna carrying a current distribution traveling along it at a prescribed speed. The radiation from such an antenna is calculated theoretically, and typical patterns are presented for conditions appropriate to the ionosphere and magnetosphere. GRA

N76-24458# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPECIFICATIONS FOR THE INTERCONNECTION OF A HOST AND AN IMP (INTERFACE MESSAGE PROCESSOR), REVISED
Jan. 1976 38 p
(Contract F08606-73-C-0032; ARPA Order 2351)
(AD-A019160; BBN-1822-Rev-76) Avail: NTIS CSCL 09/2

Enclosed please find a revision to BBN Report No. 1822, Specifications for the Interconnection of a Host and an IMP. This revision consists of a new appendix to the report plus appropriately updated front matter, as described on the back of the attached title page. The new material is 'Appendix H' Interfacing a Private Line Interface (PLI) to an IMP and a Host to a PLI. GRA

N76-24459# Naval Air Development Center, Warminster, Pa.
ROLL PLANE COMPUTER PROGRAM
Oct. 1975 143 p
(AD-A019000; NADC-75251-20A; DOD/DF-75/003A) Avail: NTIS CSCL 09/5

The Roll Plane program can be used to predict an antenna radiation pattern for a fuselage mounted antenna. The aircraft's fuselage, wings and horizontal stabilizers can be modeled in the program. The program will compute information necessary for antenna pattern plots. If the plots are desired, a magnetic tape drive is necessary to run the program. The generated tapes from the program can be used on a California Computer Products, Inc. CALCOMP pen plotter, Model 763 to produce the desired antenna patterns. GRA

N76-24460# Naval Postgraduate School, Monterey, Calif.
PROCESSING OF THE MANUAL MORSE SIGNAL USING OPTIMAL LINEAR FILTERING, SMOOTHING AND DECODING M.S. Thesis
Edison Lee Bell Sep. 1975 159 p refs
(AD-A019493) Avail: NTIS CSCL 09/4

This thesis investigates the problem of automatic transcription of the Morse signal, and describes and documents several approaches to filtering, processing, and decoding it for transcription. The baseband signal is first modeled as a modified random telegraph wave. A discrete Kalman filter and a linear smoother are then used to process the demodulated signal in order to gain a measure of the effectiveness and applicability of this model. It is shown experimentally that this model and processing yield a significant reduction in the transcription error rate. Next, a Viterbi decoder algorithm based on a simple Markov model of the code is programmed and tested. Finally, the baseband signal model is incorporated in a more general model for pre-detection Kalman filtering. It is shown that this filter permits acceptable recovery of Morse signals whose average signal-to-noise ratio is as low as -14 db in a 2 kHz bandwidth. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-24461 Arizona Univ., Tucson.
MEASUREMENT OF ULTRAFAST RELAXATION TIMES IN SEMICONDUCTORS USING PICOSECOND PULSES Ph.D. Thesis
Arthur Lee Smirl 1975 142 p
Avail: Univ. Microfilms Order No. 76-11321

Measurements on a picosecond time scale, of the nonlinear, nonequilibrium optical properties of single crystal germanium are presented. The transmission of germanium as a function of incident pulse energy is measured for two sample temperatures, 150 K and 297 K. At both sample temperatures, the germanium exhibits a condition of enhanced transmission for large pulse energies (between 10 to the 13th power and 10 to the 14th power quanta). The optical pulses, obtained from a mode-locked Nd:glass laser, are 50 to 10 psec in duration and are focused on the sample to a spot with a diameter of approximately 480 micrometers. The sample has a thickness of 5.5 micrometers.
Dissert. Abstr.

N76-24462*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
EXPERIMENTAL INVESTIGATION OF A DOUBLE-DIFFUSED MOS STRUCTURE Final Report
H. C. Lin and J. L. Halsor Washington NASA May 1976 78 p refs
(Contract NAS1-12533)
(NASA-CR-2620) Avail: NTIS HC $5.00 CSCL 09A

Self-aligned polysilicon gate technology was applied to double-diffused MOS (DMOS) construction in a manner that retains processing simplicity and effectively eliminates parasitic overlap capacitance because of the self-aligning feature. Depletion mode load devices with the same dimensions as the DMOS transistors were integrated. The ratioless feature results in smaller dimension load devices, allowing for higher density integration with no increase in the processing complexity of standard MOS technology. A number of inverters connected as ring oscillators were used as a vehicle to test the performance and to verify the anticipated benefits. The propagation time-power dissipation product and process related parameters were measured and evaluated. This report includes (1) details of the process; (2) test data and design details for the DMOS transistor, the load device, the inverter, the ring oscillator, and a shift register with a novel tapered geometry for the output stages; and (3) an analytical treatment of the effect of the distributed silicon gate resistance and capacitance on the speed of DMOS transistors.
Author

N76-24463# Nagoya Univ. (Japan). Dept. of Physics.
CALCULATION OF OSCILLATOR STRENGTHS OF DIPOLE TRANSITIONS BY THE COULOMB APPROXIMATION
Takako Kato Feb. 1976 17 p refs
(IPPJ-243) Avail: NTIS HC $3.50

The oscillator strengths of dipole transitions were computed for some rather highly ionized ions using the Coulomb approximation method of Bates and Damgaard.
Author

N76-24464# General Atomic Co., San Diego, Calif.
ELECTRICAL INSULATION PROBLEMS RELATED TO THE DOUBLET 3 COILS
L. H. Franklin 1 Oct. 1975 16 p Presented at the 6th IEEE Symp. on Engl. Probl. of Fusion Res., San Diego, Calif., 18-21 Nov. 1975
(Contract E(04-3)-167)
(GA-A-13673; Conf-751125-111) Avail: NTIS HC $3.50

The basic requirements of the magnet system for Doublet III are described. The discussion is broken into the following areas: (1) operating voltages and anticipated maximum transient voltages, (2) mechanical forces, (3) dimensional requirements, (4) coil geometry and position, (5) stored energy available, and (6) insulating requirements.
ERA

N76-24465# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
TARGET ANGLE DETERMINATION WITH A 20 LOBE ANTENNA RADIATION PATTERN [UNTERSUCHUNGEN ZUR ZIELWINKELAUSWERTUNG MIT EINER 20-KEULEN-ANTENNENCHARAKTERISTIK]
H.-J. Bueckmann Dec. 1974 53 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(Rept-5-74) Avail: NTIS HC $4.50

Possible weightings proper to a 3-dimensional radar detection performance are described for the case of a receiving paraboloid antenna pattern synthesized by 20 single patterns of spatially separated feed horns. Based on the patterns of an antenna model measured at the 20 discrete feedpoints, weightings were examined for sidelobe reduction which can be realized by means of suitable RF-networks as well as by computerized evaluation. Weightings were investigated for target angle determination. With regard to the establishment of two-dimensional difference curves, weighting coefficients for the 20 single patterns are given and parameters for simple approximations of the difference curves tabulated for quick evaluation. The different tolerance effects were examined and the resulting target angle errors computed.
Author (ESA)

N76-24466# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
ACCEPTANCE TESTS OF THE ANTENNA AND PEDESTAL OF THE HELIOS COMMAND STATION
Peter Sliwinski, Herwig Oettl, and Dusan Arko 14 Nov. 1975 69 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(Contract BMFT-WRF-4058)
(DLR-Mitt-75-23) Avail: NTIS HC $4.50; DFVLR, Cologne DM 26

The tests are used to illustrate the complex relationship between the mechanics, control and steering equipment (drives), and the radiation characteristics of the antenna. Coincidence of the mechanical and electrical axes at an elevation angle of 45 deg is achieved by adjusting the individual elements. The surface roughness of the main dish sets an upper limit to the frequency range. The maximum velocity and acceleration of the pedestal largely determines the field of application for space probes as well as earth satellites. The pointing accuracy and the gain of the antenna must be made compatible. The points which have to be considered when preparing the specifications and acceptance tests of large steerable dish antennas are outlined.
Author (ESA)

N76-24467# Bristol Univ. (England). Dept. of Electrical Engineering.
SMALL INDUCTION MOTORS SUPPLIED FROM HIGH-FREQUENCY TRANSISTOR INVERTORS Ph.D. Thesis
Farhad Baghai Jun. 1974 134 p refs
Avail: NTIS HC $6.00

The design and development of an electric drive with an operating speed of 5.000 - 11,000 rev/min are described. To obtain these high speeds an induction motor is supplied from a transistor inverter. Due to the high operating speed, the power/weight ratio of the motor is high. A high proportion of the cost is associated with the inverter. For this reason single-phase systems, rather than 3-phase systems, are considered. The inverter output waveforms employed are simple to generate, but are nevertheless adequate for supplying small induction motors. Special problems in using transistors for this application are discussed and resolved. operation and construction of a 3-phase transistor alternator are also described.
ESA

N76-24468# Bristol Univ. (England). Dept. of Electrical Engineering.
NEW INDUCTION MOTORS: DESIGN AND TESTING Ph.D. Thesis
H. M. El-Shewy Mar. 1973 324 p refs
Avail: NTIS HC $9.75

A new method of testing induction motors (phantom loading)

and the design and tests of induction motors with novel windings are described. Phantom loading enables a complete heat-run test for two identical induction motors to be carried out by purely electrical means. This is done by feeding dc current into the stator windings of the two machines in such a way that the direction of the dc current in one phase is opposite to the directions in the two other phases. Two new techniques for pole amplitude modulation windings are described: the side-by-side symmetrization and transposition. ESA

N76-24469# Institut Franco-Allemand de Recherches, St. Louis (France).

BALLISTIC ISL TELEMETRY SYSTEM. ACCELERATION RESISTANT MINIATURIZED TELEMETRY AND SENSOR MODULES IN CERAMIC THICK FILM TECHNOLOGY [BALLISTICHE TELEMETRIE ISL. BESCHLEUNIGUNGSFESTE MINIATURISIERTE TELEMETRIE- UND SENSORMODULN IN KERAMIK-DICKSCHICHT-TECHNIK]

G. Schultze 28 Aug. 1975 26 p In GERMAN Presented at the BWB Working Group Meeting 'Telemetrie', Meppen, West Ger., 28-29 Oct. 1975 and the Carl-Cranz-Ges. Seminar 'Ballistische Messtech.', Weil am Rhein, West Ger., 10-14 Nov. 1975

(ISL-CO-207/75) Avail: NTIS HC $4.00

This system consists of nine modules of 10x21x3 cu mm and can resist accelerations of up to 100,000 g, so that it can be used for in-flight monitoring of projectiles in ballistic test ranges. Development of a new subminiature telemetry system is mentioned, and applications are outlined for ballistic telemetry. Transmission systems for interior ballistics are reviewed, and acceleration resistant sensor systems are discussed. ESA

N76-24470# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

FEED SYSTEM FOR 3D RADAR OPERATION WITH A CASSEGRAIN ANTENNA [ERREGERSYSTEM FUER 3D-RADARBETRIEB MIT EINER CASSEGRAIN-ANTENNE]

H. Gniss Mar. 1975 65 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(Rept-1-75) Avail: NTIS HC $4.50

A feed system for a Cassegrain antenna was designed by calculating off-axis beams. This feed system excites an antenna pattern with 10 beams staggered in the elevation plane, covering 10 half-power beamwidths. Through the use of additional axial defocusing of the individual feeds the pattern deformations are held within a relatively small value. The theoretical results were experimentally verified. The possibility of increasing the number of angular ranges to 20, half-power beamwidth, by connecting a larger number of feeds is analyzed. To gain additional insight into the abberations of a Cassegrain system the field in the near vicinity of the focus is discussed for incident plane waves. Author (ESA)

N76-24471# Manlabs, Inc., Cambridge, Mass.

PHYSICAL CHARACTERIZATION OF ELECTRONIC MATERIALS Final Report, 12 Sep. 1972 - 30 Jun. 1975

S. Andrew Kulin, Harvey Nesor, and Peter Neshe 31 Jul. 1975 134 p refs

(Contract F19628-73-C-0051; AF PRoj. 5620)

(AD-A018661; AFCRL-TR-75-0480) Avail: NTIS CSCL 20/12

ManLabs, Inc. is conducting a research effort in support of work carried out by the Properties and Phenomena Branch, Solid State Sciences Laboratory, and the Microwave Acoustics Branch of the Microwave Physics Laboratory of the Air Force Cambridge Research Laboratories. This effort is directed to the characterization of the physical properties of electronic materials and devices and to the fabrication of various electro-optical experimental components. The various experimental methods involved are X-ray diffraction and orientation of crystals, crystal fabrication (cutting, grinding, polishing), metallographic preparations, electron probe microanalysis, electron diffraction analysis, chemical analysis, bend testing, elastic constant measurements, processing techniques, pole figure determinations and hardness. Author (GRA)

N76-24472# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTROTECHNICAL HANDBOOK. VOLUME 1, BOOK 2: 4TH EDITION REVISED SELECTIONS 19, 20, 24, AND 26

P. G. Grudinskogo and G. N. Petrova 10 Apr. 1975 530 p refs Transl. into ENGLISH from the book "Elektro-Tekhn. Spravochnik." (Moscow), v. 1, no. 2, 4th edition, 1971 p 530-611, 639-709, 752-767, 811-832

(AD-A018260; FTD-HC-23-1545-74) Avail: NTIS CSCL 09/1

Contents: High-voltage fuses, discharge arresters and reactance coils; High-voltage assembly devices; Mobile electric power stations; Chemical sources of current and use of them; and Selection of storage batteries for electrical stations and substations. GRA

N76-24473# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.

HIGH EFFICIENCY DUAL MODE OCTAVE BANDWIDTH TRAVELING WAVE TUBE Final Technical Report, Jan. 1974 - Jun. 1975

Arthur E. Manoly and Mark K. Scherba Griffiss AFB, N. Y. RADC Oct. 1975 52 p

(Contract F30602-74-C-0099; AF Proj. 5573)

(AD-A018441; EDD-W-4388-F; RADC-TR-75-239) Avail: NTIS CSCL 09/1

Techniques resulting in high overall efficiency over extended bandwidths have been considered in this study effort. Some of the techniques have been pursued during previous efficiency studies in which high efficiencies have been demonstrated on CW and pulsed traveling-wave tubes. The present study is complicated by both the high average power requirement and the 10 dB pulse-up dual mode capability. In addition, periodic permanent magnet focusing has added to the complexity of the design task. Experimental cold testing dealing with helices of different pitch has been performed. Suitable shaping methods have resulted in high interaction impedances with small phase velocity variations over octave bandwidths. Large signal computer evaluations considering beam-circuit wave velocity resynchronization schemes have been conducted. An existing experimental dual mode electron gun has been scaled and structurally adapted for PPM focusing. A satisfactory match has been designed and demonstrated for both input and output transducers. A helix phase velocity taper is used to improve basic interaction efficiencies. A three-stage, double depressed collector is added to further improve overall conversion efficiency. GRA

N76-24474# Stanford Univ., Calif. Microwave Lab.

MICROWAVE ACOUSTIC BULK DEVICE TECHNIQUE STUDIES Interim Report, 1 Nov. 1974 - 30 Apr. 1975

G. S. Kino, B. T. Khuri-Yakub, H. J. Shaw, and K. N. Bates Griffiss AFB, N. Y. RADC Nov. 1975 32 p refs

(Contract F30602-74-C-0038; AF Proj. 5573)

(AD-A018443; ML-2471; RADC-TR-75-267) Avail: NTIS CSCL 09/1

In the previous report results on a ZnO on Si convolver were described, where a conversion efficiency of - 55 dBm was obtained. During the reporting period a new type of broadband matching network which makes it possible to increase the bandwidth of the interdigital transducers from 8 to 22 MHz was designed and tested. New types of diffusion layer transducers using p(+) elements laid down in Si were also tested; these can be switched on and off by incident light or by changing an applied dc potential. The work on the diffusion layer transducers to improve their efficiency is also continuing, and to use a new dc sputtering station to make more reproducible convolver devices is also intended. In the last report a new approach to analog/digital conversion was introduced. It operates by comparing a reference signal, having a linearly varying amplitude versus time, with the analog input signal whose amplitude is to be digitized. The reference signal is produced by passing an rf tone pulse through an interdigital acoustic wave transducer. The basic convolution property of the transducer results in the production of the required linearly varying ramp. An integrated circuit comparator and counter are used to produce the digital readout. During the reporting period a first experimental model has been constructed, utilizing a 50 MHz surface acoustic wave delay line, and using four-bit words, which has established the principle of the device. GRA

N76-24475# Texas Instruments, Inc., Dallas.

APPLICATION OF MOS HARDENING TECHNIQUES TO

BIPOLAR DEVICE PROCESSING Final Report, 15 May 1974 - 15 May 1975
J. S. Crabbe Jul. 1975 82 p refs
(Contract N00164-74-C-0378)
(AD-A018363; TI-03-75-34; NAD-CR-TR/7024/C74/285) Avail: NTIS CSCL 09/1

Type operational amplifiers and test bars containing the input npn and lateral pnp transistor of the amplifier were fabricated by several processes which applied where possible techniques developed for hardening MOS transistors to ionizing radiation. The process variations considered included oxide growth conditions, annealing cycles and methods for aluminum evaporation. Data are presented which describes the hFE of the vertical npn and lateral pnp transistor on the test bar as a function of collector current and CO-60 dose for each device process variation. The effect of CO-60 irradiation on the input bias currents and offset voltage of amplifiers irradiated in an input-stressed and a unity-gain configuration is described. The improvement in total ionizing dose hardness which was achieved was dependent on the parameter used for comparison, the bias condition of the amplifier during irradiation, and the magnitude of the parameter at which the comparison was made. At total doses of less than 300,000 rads(Si) a typical improvement in radiation tolerance of 1.5-3.0 was achieved for amplifier input bias current and the hFE(IC = 1,10 microamp) of the npn and lateral pnp transistors.
Author (GRA)

N76-24476# Thermal Technology Labs., Buffalo, N.Y.
DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE HIGH POWER SUPPLIES, VOLUME 1 Final Technical Report, Jun. 1972 - Jan. 1975
R. Haumesser, D. Lockwood, R. McNall, and James P. Welsh Jun. 1975 332 p refs
(Contract F33615-72-C-1944; AF Proj. 3145)
(AD-A018545; AFAPL-TR-75-15-Vol-1) Avail: NTIS CSCL 09/1

This Final Technical Report describes the progress and results achieved during two years of effort in the successful development of lightweight high power airborne transformers. The feasibility of developing continuous duty lightweight high power airborne transformers having typical specific weights of the order of 0.25 lbs per KVA or less at 400 Hz or higher, has been successfully established. Design procedures, methodologies, and computer programs have been developed which will permit the optimization of selected transformer characteristics and detail the design of sinusoidal, inverter, or pulse transformers in the power range of 250 KVA to 100 MVA with voltages up to 200 KV. Volume I of this report describes the technical work done and the results obtained during this transformer development program. Volume 2 is a complete Computer User Manual giving transformer design procedures which have been implemented on ASD's CDC 6600 computing systems in Extended FORTRAN 4 SCOPE 3.4 operating system. GRA

N76-24477# Thermal Technology Labs., Buffalo, N.Y.
DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE HIGH POWER SUPPLIES, VOLUME 2 Final Technical Report, Jun. 1972 - Jan. 1975
R. Haumesser, D. Lockwood, R. McNall, and James P. Welsh Jun. 1975 112 p refs
(Contract F33615-72-C-1944; AF Proj. 3145)
(AD-A018546; AFAPL-TR-75-15-Vol-2) Avail: NTIS CSCL 09/1

A procedure, Function TDP, and its associated subroutines and functions, determines a consistent set of values for dependent design parameters for a given set of independent design parameter values. A listing of transformer design parameters and a consistent set of units are presented. These are passed in and out of TDP through a 300 element array PV in labeled common block PVDC. Section 2 discusses general features and limitations of TDP. Considerations that must be taken into account in order to avoid infeasable transformer designs are discussed in Section 3. Program TDPLOT is an aid in optimizing transformer designs. This procedure generates an output in the form of 3-dimensional line printer and/or Cal-Comp plots of the objective function and final transformer design parameter values. A description of the input required by PROGRAM TDPLOT and the output that is generated is discussed in Section 4. Appendix 2 discusses computing system requirements and presents an example run. An FTN compiler source listing of the program is provided in Appendix 3. GRA

N76-24478# TRW, Inc., Lawndale, Calif. Semiconductor Div.
TOP COLLECTOR CONTACTED MICROWAVE POWER TRANSISTOR Quarterly Report for the period ending 1 Jul. 1975
Al Harrington, George Schreyer, and Jim Steenbergen Aug. 1975 84 p refs
(AD-A018676) Avail: NTIS CSCL 09/1

This report covers the first six months of work on Naval Research Contract No. N00014-75-C-0405, (Top Collector Contacted Microwave Power Transistor). The objective of the contract is to investigate the monolithic integrated circuit approach for the fabrication of RF power transistors and associated matching networks to eliminate hand working, wire bonding and to provide improved uniformity, yield, reliability and ultimately, lower cost. Specifically, Phase I of this work calls for an all top contacted 30 Watt, 1 to 1.5 GHz power transistor. During this reporting period work has been completed on the top contacted design and the first devices. The design is of the interdigitated type and utilizes several innovative design techniques for improved performance and reliability which are discussed. Author (GRA)

N76-24479# Texas Univ., Austin. Electronics Research Center.
LIQUID STATE ELECTROMAGNETIC TRANSDUCER
Hidemi Ajisaka and E. L. Hixson 1 Jun. 1975 162 p refs
(Contract F44620-71-C-0091; AF Proj. 6813)
(AD-A019540; TR-172; AFOSR-75-1557TR) Avail: NTIS CSCL 09/1

In the study, a magnetic field is applied normally to a duct which contains an electrically conducting fluid. Electrodes are placed on two of the duct walls which lie parallel to the magnetic field. An electric current conducted through the fluid produces pressure, and the fluid velocity produces an electrical potential across the electrodes. This principle is applied and investigated for the development of a new type of underwater transducer. A theoretical model of the liquid state electromagnetic transducer is obtained from magnetohydrodynamic equations, and is provided in the form of three-port equations and electrical-acoustical equivalent circuits. GRA

N76-24480# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
FAULT ANALYSIS IN ELECTRONIC CIRCUITS AND SYSTEMS Interim Report
R. Saeks, S. R. Liberty, M. N. Ransom, S. Sangani, and L. Tung Nov. 1975 202 p refs
(Contracts N00014-75-C-0924; N00014-73-A-0434-0003; Grant NSF GK-31808)
(AD-A018633) Avail: NTIS CSCL 09/3

Several Studies resulting from a research program directed at the development of mathematical foundations for fault analysis in electronic circuits and systems are reported. Specific topics covered include fault analysis by functional methods, fault analysis in linear and affine sequential circuits, and fault prediction. GRA

N76-24481# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
DEVELOPMENT OF LARGE RARE EARTH-COBALT MAGNETS FOR MICROWAVE TUBES Final Report
Jun. 1975 79 p refs
(Contract N00039-73-C-0280)
(AD-A012405; PT-4467) Avail: NTIS CSCL 09/1

The program's objective is to extend the application of rare earth-cobalt magnets to large microwave tubes by adapting the existing technology to provide highly uniform, high energy product permanent magnets in sizes up to 3 inches in diameter. In large sizes, the cost of magnet material fabricated from Sm-CO is often prohibitive. Therefore the development of lower cost magnet materials was pursued. The weight and cost savings, along with systems improvement to be realized with the availability of these large magnets, were demonstrated by developing magnetic circuit designs for microwave tubes now using larger or more costly methods of magnetic focusing. GRA

N76-24482# Princeton Univ., N.J. Solid State and Materials Lab.

A COMPUTER PROGRAM TO CALCULATE SURFACE STATE DENSITIES AND LATERAL NONUNIFORMITIES IN METAL-OXIDE-SEMICONDUCTOR

T. A. Pandolfi and B. S. H. Royce 22 Dec. 1975 59 p
(Contract N00014-75-C-1022)
(AD-A019438; PSSL-221275) Avail: NTIS CSCL 09/1

A Basic language computer program to control data taking and parameter calculation of metal-oxide-semiconductor devices is presented. The program calculates surface potential, surface state density, apparent doping density, and depletion width. GRA

N76-24483# Naval Electronics Lab. Center, San Diego, Calif.

EIGHT-TERMINAL, BIDIRECTIONAL, FIBER OPTIC TRUNK DATA BUS Final Report, Jul. 1974 - Jun. 1975

Daniel E. Altman 15 Nov. 1975 45 p refs
(RF54545002)
(AD-A019429; NELC/TR-1969) Avail: NTIS CSCL 09/1

Extension of a previously demonstrated fiber optic data transmission system to eight terminals and bidirectional operation is demonstrated to be within the state of the art. At a 5MB/s data rate a worst-case SNR of 5 dB was demonstrated. Improved optical couplers comprising a dual internal mirror mixing block mounted in a low-loss, all-metal holder and integral electronics are described. GRA

N76-24484# Microwave Associates, Inc., Burlington, Mass.

PRODUCTION ENGINEERING MEASURE FOR HIGH BURNOUT RESISTANT MIXER DIODES Quarterly Report, 1 Nov. 1974 - 31 Jan. 1975

Y. Anand Jul. 1975 46 p
(Contract DAAB05-73-C-2065)
(AD-A019434; ECOM-2065-7-73; QR-7) Avail: NTIS CSCL 09/1

The object of the program is to develop the processes, techniques and manufacturing methods to manufacture S, X and Ku-band high burnout resistant mixer diodes. These diodes are to be used as replacements for 1N21, 1N23 and 1N78 type point contact diodes in existing S, X and Ku-band receivers. During the quarter, S, X and Ku-band Schottky-Barrier diodes were manufactured and were characterized for their RF performance. GRA

N76-24485# ITT Electron Tube Div., Easton, Pa.

LONG LIFE X-RAY TUBES FOR PORTABLE SOURCES Triannual Report, 1 Jun. - 30 Sep. 1975

Charles L. Shackelford Dec. 1975 17 p
(Contract DAAB07-75-C-1334; DA Proj. 1S7-62705-AH-94)
(AD-A019505; ECOM-75-1334-1; AR-1) Avail: NTIS CSCL 09/1

The objective of the development is a tube for portable X-ray machines with substantially increased life over that presently available. Previous experience with this class of tube has shown cathode wear to be a major factor in its life. The present study will examine a number of cathode variations and changes in tube processing. Test equipment was ordered. Two tube designs were made. Substitute tubes for immediate testing at the 100 KV level have been built and initial tests are satisfactory. GRA

N76-24486# Harry Diamond Labs., Adelphi, Md.

ELECTROMAGNETIC PULSE COUPLING WITH LOSSLESS MULTICONDUCTOR TRANSMISSION LINES

Janis Klebers Jun. 1975 38 p
(DNA Proj. NWER-QAXEB075)
(AD-A019099; HDL-TR-1711) Avail: NTIS CSCL 09/1

The matrix formulation of the transmission line equations was applied in a semi-empirical manner to predict electromagnetic coupling with multiconductor transmission lines. Experimental procedures were used for measuring characteristic electrical parameters for transmission lines. The NLINE multiconductor transmission line computer program was used with experimental data for analysis of transmission-line samples made up of 2, 3, and 11 conductors. Parametric variations in angle of incidence and transmission line parameters were studied and compared with experimental results. The validity of simplifying approximations was checked with experimental data. GRA

N76-24487# Harry Diamond Labs., Adelphi, Md.

TEST PROCEDURES FOR EVALUATING TERMINAL PROTECTION DEVICES USED IN EMP APPLICATIONS

Robert L. Williams, Jr. Jun. 1975 85 p refs
(DNA Proj. NWED-QAXEB099; HDL Proj. E044E2)
(AD-A019098; HDL-TR-1709) Avail: NTIS CSCL 09/1

Certain commercially available components were tested to establish test procedures for characterizing terminal protection devices used in electromagnetic-pulse (EMP) applications. The devices tested include spark gaps, filters, avalanche diodes, and various other nonlinear components. Square pulses of 50- and 500-nsec duration and up to 11 kV in amplitude, with rise times of 2 to 4 nsec, were applied to the devices. Response time and energy leakage were recorded for each test. Insertion loss and approximate failure level were measured for each device. Results are presented in tabular form. The devices that appear suitable for terminal protection include spark gaps, some filters, and some semiconductor devices with breakdown voltage less than about 50. GRA

N76-24488# Harry Diamond Labs., Adelphi, Md.

TESTING AND CHARACTERIZATION OF RADIATION HARDENED C-MOS DEVICES Progress Report, Fiscal Year 1974

Harvey A. Eisen, Arnold S. Epstein, and Roland A. Polimadei Aug. 1975 44 p refs
(DNA Proj. NWED-QAXTB029)
(AD-A019189; HDL-PR-75-3) Avail: NTIS CSCL 09/1

The susceptibility to ionizing radiation of small sample lots of candidate hardened C-MOS devices was evaluated. All except an early pilot line device with an undoped SiO2 gate dielectric exhibited small total dose susceptibility out of 1,000,000 rads (Si). Other studies (e.g., annealing and high temperature performance) also are reported. A test plan for more extensive evaluation of larger lots is discussed. Future work will concentrate on instrumentation development to implement that test plan and evaluation of new samples according to the plan. GRA

N76-24489# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.

ADVANCED SOLID STATE MICROWAVE TECHNIQUES

G. C. Dalman, L. F. Eastman, C. A. Lee, and J. Frey Nov. 1975 237 p refs
(Contract F30602-74-C-0001; AF Proj. 5573)
(AD-A018899; RADC-TR-75-269) Avail: NTIS CSCL 09/1

This report describes the research accomplished during the third biannual period of a three year research program dealing with advanced concepts of microwave generation and control in solids. A report is made on microwave solid state devices and circuits. Included are: GaAs Read Diodes; Amplifier Characteristics; Measurement of IMPATT Diode Amplifier Parameters; Computer Experiments on TRAPATT Diodes; High Power and Efficiency CW Transferred Electron Oscillators; Compound Semiconductor Transistor Study; Automated Network Analyzer; Submicron Gate Field Effect Transistor; IMPATT Diode Load Characteristics; and Interaction of Distributed IMPATT Oscillators. A report is also made on materials and fabrication techniques. The topics discussed are: The Epitaxial Growth of Thin GaAs Layers; Read Structures; and Electric-Current-Controlled LPE Growth of GaAs. GRA

N76-24490# Naval Research Lab., Washington, D.C.

SOME COMMENTS ON POWER COMBINER/SWITCH MATRICES

C. W. Young, Jr. and M. L. Reuss, Jr. 26 Nov. 1975 28 p
(XF54545007)
(AD-A018697; NRL-7937) Avail: NTIS CSCL 09/5

High-power signals can be switched with low-power switch control using hybrid matrices and parallel amplifiers. This study treats the effects of input phase and amplitude errors on the outputs of combiner/switch matrices. Worst-case isolation and loss are considered as a function of the errors mentioned and of the unbalance of the hybrids forming the matrix. Effects of each parameter are considered individually; a computer program to study the effects of several errors simultaneously is listed in the report. GRA

N76-24491# Naval Ammunition Depot, Crane, Ind.
NEUTRON HARDNESS ASSURANCE FOR BIPOLAR TRANSISTORS THROUGH DETERMINATION OF PHYSICAL PARAMETERS Final Report
R. D. Blice and J. A. Munarin Nov. 1975 210 p refs
(AD-A019155; AFWL-TR-74-327) Avail: NTIS CSCL 09/1

A nondestructive method of neutron radiation hardness assurance is developed for bipolar transistors using a detailed one-dimensional model to obtain the powers (sensitivity parameters) relating postirradiation h sub FE and V sub CE(sat) at any operating point to preirradiation physical parameters and preirradiation electrical measurements at specified operating points. The transistor model uses physical dimensions, doping concentrations, diffusion constants, electric fields, and minority carrier lifetimes determined from terminal electrical measurements. The sensitivity parameters are applied to (1) predicting postirradiation h sub FE and V sub CE(sat) from preirradiation electrical measurements and the physical parameters extracted from them and (2) establishing upper or lower bounds on preirradiation physical parameters. In this study, sensitivity parameters are calculated for a medium-power double-diffused planar epitaxial NPN device (2N2222A). GRA

N76-24492# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
PRODUCTION SUITABILITY OF AN ELECTROFORM CONDUCTIVE WAX PROCESS FOR THE MANUFACTURE OF FLUIDIC SYSTEM Final Report, 5 Nov. 1973 - 31 Jan. 1975
Robert Lewis, Walter Posingies, and Burton Scott Nov. 1975 130 p
(Contract DAAJ02-74-C-0012)
(AD-A018874; GAPD-W0564-FR-1; USAAMRDL-TR-75-49) Avail: NTIS CSCL 09/5

This is a three-phase program to determine and demonstrate the production suitability of the Electroform Conductive Wax process in conjunction with conventional production processes for the manufacture of fluidic systems. During this phase, Phase I, an integrated amplifier-manifold hydrofluidic stability augmentation system using the Electroform Conductive Wax process was successfully designed, fabricated, and qualification tested, and a pilot production line using the Electroform Conductive Wax process was defined. The pilot production line includes all manufacturing, inspection, and assembly equipment necessary to produce the integrated amplifier-manifold hydrofluidic stability augmentation systems. During Phase II, the pilot production line will be set up and checked out by fabrication and test of these systems. The fabrication and test data is to be analyzed and process modifications are to be accomplished as necessary. During Phase III, a small 'proof' production run is to be accomplished, component quality determined, and a Technical Data Package prepared. Author (GRA)

N76-24493# New Jersey Inst. of Technology, Newark.
INTEGRATED DIELECTRIC RESONATOR AND ANTENNA MILLIMETER-WAVE STRUCTURES Technical Report, 1 Nov. 1974 - 31 Aug. 1975
Gerald M. Whitman and Stewart J. Maurer Oct. 1975 43 p refs
(Contract DAHC04-75-G-0058)
(AD-A018986; NJIT-10; ARO-12864.1-R-EL) Avail: NTIS CSCL 09/1

A theory is outlined which yields physical insight into the wave processes taking place inside integrated semiconductor resonator and radiator devices. The information obtained will aid in the design of antennas for millimeter-wave transmitters and receivers. The configuration of a wedge excited by the mode structure of a two dimensional dielectric slab is examined. A review of the mode and ray structure in the slab and in a wedge both of constant reflection coefficients is given. Approximate integral expressions for the field in an actual wedge is developed. Reflections from the wedge air-dielectric boundaries are included by using multiple Fresnel plane wave reflection coefficients. The method of solution allows for the convenient tracking of beams which follow ray trajectories as they journey toward the wedge apex, reach a caustic and are reversed. GRA

N76-24494# RCA Corp., Burlington, Mass. Government Communications and Automated Systems Div.
PRODUCTION ENGINEERING MEASURES: AUTOMATIC ASSEMBLY OF HYBRID INTEGRATED CIRCUITS Quarterly Progress Report, 1 Nov. 1974 - 31 Jan. 1975
D. R. Bokil 21 Jul. 1975 71 p
(Contract DAAB05-73-C-2039)
(AD-A018756; QPR-4) Avail: NTIS CSCL 09/5

Effort has been initiated to develop automated techniques and equipment capable of mass production of thick film hybrid integrated circuits. The CMOS amplifier HDL Drawing Number 11722540, used in the XM734 multi-option fuze has been selected as the assembly which will serve as the test vehicle. GRA

N76-24495# RCA Solid State Technology Center, Somerville, N.J.
IMPROVED RADIATION HARDNESS OF BIPOLAR LINEAR CIRCUITS Quarterly Report, 1 Jul. - 30 Sep. 1975
Faith Lee Nov. 1975 14 p
(Contract N00014-74-C-0451; DNA Proj. NWED-QAXTD043)
(AD-A019479) Avail: NTIS CSCL 09/5

This Quarterly Report describes progress in the second phase of this program. Results of amplifier and capacitor testing are presented. GRA

N76-24496# G and W Electric Specialty Co., Blue Island, Ill.
HIGH AMPACITY POTHEADS Final Report
J. H. Nicholas and J. Selsing Oct. 1975 128 p refs
(Contract E(49-18)-1582)
(PB-248342/8; EPRI-7817-1) Avail: NTIS HC $6.00 CSCL 09A

Three methods are evaluated for achieving higher pothead ampacities using one cable per phase and without any major modification in the pothead's dielectric design features or use of a larger cable conductor size. Topics discussed include: (1) pothead designs that are based on maintaining a subambient temperature in the oil dielectric within the potheat porcelain insulator to obtain an increase in ampacity over a self-cooled rating; (2) a pothead design that utilizes the core zone of a hollow core conductor cable to transfer the major heat energy developed by the cable conductor 12R losses to an air heat exchanger located at the high voltage end of the pothead, and (3) the influence of three different types of low viscosity oils on the thermal characteristics of the pothead designs. GRA

N76-24497# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
A SPECTRAL THEORETIC APPROACH TO FAULT ANALYSIS IN LINEAR SEQUENTIAL CIRCUITS Interim Report
S. Sangani Aug. 1975 73 p refs
(Contracts N00014-75-C-0924; N00014-73-A-0434-0003; NR Proj. 122-105; NR Proj. 121-409)
(AD-A018985) Avail: NTIS CSCL 09/5

In this paper the problem of fault analysis in linear and affine sequential circuits is treated. These classes of systems provide for the treatment of several linear and nonlinear faults common in digital circuitry. The solution to the linear and affine sequential circuit problem is obtained via the development of a spectral theory for such systems over finite fields. A stepwise fault analysis procedure for this problem class is presented along with many examples illustrating the advantages that memory provides in digital fault analysis. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-24498 British Library Lending Div., Boston Spa (England).
THE PROBLEM OF HEATING THIN BODIES WITH A GIVEN ACCURACY

A. N. Minaev, V. Ya. Grinberg, V. M. Olyshanskii, and Yu. S. Borbots [1975] 11 p Transl. into English from Izv. VUZ Chern. Met. (USSR), no. 7, 1975 p 184-186
(BLL-M-25262-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Selection of a steady state temperature schedule is examined in the zones of a straight through multiple zone furnace when heating products with varying thicknesses with a given accuracy. A preset accuracy of heating thin bodies with a schedule t sub furnace = const in each zone of the straight through furnace is ensured in the presence of two technological zones (two zone heating schedule). For optimizing the other parameters when ensuring a given accuracy of heating (e.g. from the criterion of minimum fuel consumption), it is necessary to have not less than three technological zones (three zone heating schedule), or to vary the heating time with a two zone schedule. Author

N76-24499 British Library Lending Div., Boston Spa (England).
MEASUREMENTS OF VELOCITY FIELDS OF HYPERSONIC FLOW BY A LASER DOPPLER ANEMOMETER
B. S. Rinkevichyus, A. V. Tolkachev, and V. N. Kharchenko [1974] 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Zhidk. Gaza (Moscow), no. 4, Jul.-Aug. 1974 p 69-73
(BLL-RRE-Trans-471-(8036.625)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Experimental equipment for measuring local velocities of gas flows in the range 100 to 10,000 m/sec by use of the Doppler effect, is described. Results of investigations into a free flow and its flow around a sphere in a hypersonic wind tunnel for free stream Mach 5 are produced and compared with velocity measurements made using temperature and pressure nozzles, and also with theoretical calculations. The introduction of light scattering particles into the flow is also considered. Author

N76-24500 National Lending Library for Science and Technology, Boston Spa (England).
CRITICAL VELOCITY OF GAS COUNTER-CURRENT FLOW WITH DISCHARGE OF GRANULAR MATERIAL THROUGH AN OPENING
E. V. Maksimov, V. T. Plitsyn, B. S. Fialkov, and V. A. Barsukova [1975] 11 p refs Transl. into ENGLISH from Izv. Vysshikh Vchebn. Zavedenii, Chernaya Met. (Moscow), no. 10, 1975 p 37-40 In ENGLISH and RUSSIAN
(NLL-M-25318-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Results are presented of experimental investigations to determine the critical gas velocity in a bed. Experiments were carried out on sinter, pellets and wheat. The counter-current reagent used was air, helium, hydrogen and mixtures of 34 and 62% of helium with air. An analytical formula is given which is universal and satisfactorily accurate for calculating the influence of parameters of the discharge opening and the solid and gas phases on the critical gas counter-current velocity for the case of discharge of granular material through an opening in a horizontal plane. Author

N76-24501 Ernst-Mach-Inst., Freiburg (West Germany).
BLAST WAVE FROM A CENTRALLY INITIATED DETONATING GAS BUBBLE
E. Schmolinske 1976 24 p refs In GERMAN; ENGLISH summary
(Rept-1/76) Avail: Issuing Activity

An experimental, schlieren optical, investigation with detonating gas bubbles filled with equimolar acetylene-oxygen mixture yields the velocity of the expanding detonation products and of the blast wave as a function of the distance to the detonation center. Theoretical calculations of the escape of the detonation products into air are in good agreement with experimental observations. Author (ESA)

N76-24502*# General Dynamics/Convair, San Diego, Calif.
LOW-G FLUID TRANSFER TECHNOLOGY STUDY Final report, May 1974 - Feb. 1976
J. A. Stark May 1976 289 p refs
(Contract NAS3-17814)
(NASA-CR-134911; CASD-NAS-76-014) Avail: NTIS HC $9.25 CSCL 20D

Technology gaps and system characteristics critical to cryogenic and noncryogenic in-orbit fluid transfer were identified. Four different supply systems were conceptually designed as space shuttle payloads. These were: (1) space tug supply - LH2, LO2, N2H4, He - linear acceleration for liquid acquisition with supply module and tug separated from shuttle, (2) tug supply using orbiter drag, (3) orbiter supply - N2O4,MMH,He, H2,O2 - surface tension screens, (4) multiple receivers supply 0 solar electric propulsion stage, Hg, diaphragm - HEAO B, HEe, paddle fluid rotation-satellite control section, N2H4, screens. It was found that screens had the best overall potential for low weight and simplicity, however, thermal problems with cryogenics still need final resolution. Author

N76-24503*# General Dynamics/Convair, San Diego, Calif.
LOW-G FLUID TRANSFER TECHNOLOGY STUDY, EXECUTIVE SUMMARY Summary Report, May 1974 - Feb. 1976
J. A. Stark May 1976 26 p
(Contract NAS3-17814)
(NASA-CR-135020; CASD-NAS-76-017) Avail: NTIS HC $4.00 CSCL 20D
For abstract, see N76-24502.

N76-24504*# General Dynamics/Convair, San Diego, Calif.
AN ANALYTICAL STUDY OF REDUCED-GRAVITY FLOW DYNAMICS
Robert D. Bradshaw, James L. Kramer, and John L. Zich Apr. 1976 67 p refs
(Contract NAS3-17839)
(NASA-CR-135023; CASD-NAS-76-015) Avail: NTIS HC $4.50 CSCL 20D

Addition of surface tension forces to a marker-and-cell code and the performance of four incompressible fluid simulations in reduced gravity, were studied. This marker-and-cell code has a variable grid capability with arbitrary curved boundaries and time dependent acceleration fields. The surface tension logic includes a spline fit of surface marker particles as well as contact angle logic for straight and curved wall boundaries. Three types of flow motion were simulated with the improved code: impulsive settling in a model Centaur LH2 tank, continuous settling in a model and full scale Centaur LO2 tank and mixing in a Centaur LH2 tank. The impulsive settling case confirmed a drop tower analysis which indicated more orderly fluid collection flow patterns with this method providing a potential savings in settling propellants. In the LO2 tank, fluid collection and flow simulation into the thrust barrel were achieved. The mixing simulation produced good results indicating both the development of the flow field and fluid interface behavior. Author

N76-24505*# Michigan State Univ., East Lansing. Div. of Engineering Research.
THE VORCOM. PART 1: ANALYTICAL CONSIDERATIONS Annual Report
John F. Foss 30 Apr. 1976 53 p refs
(Grant NGR-23-004-091)
(NASA-CR-148130; AR-2) Avail: NTIS HC $4.50 CSCL 20D

The analytical considerations which support the computation of (1) two components of the velocity vector from an X-array and (2) the transverse vorticity from the X-array and an adjacent parallel wire pair are presented. The electronic circuit which will execute these computations at a 50 khz rate is also described. The factors limiting the accuracy of the measurements are identified and quantitative estimates are given for a typical x-probe. An extensive analysis of the factors which effect the output and which are unknown (or unknowable) during the measurements is presented. Quantitative estimates of these effects are developed in the form of an uncertainty analysis. Numerical values, calculated using the analytical structure of the response equations, are tabulated; other estimates which require special experiments are described. Author

N76-24506*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GRAVITY EFFECTS ON FLAME SPREADING OVER SOLID SURFACES
Charles R. Andracchio and Thomas H. Cochran Washington May 1976 24 p refs
(NASA-TN-D-8228; E-8601) Avail: NTIS HC $3.50 CSCL 21B

The effects of gravity on the spreading of a flame over a solid combustible surface were determined. Flame propagation rates were measured from specimens of thin cellulose acetate sheets burning in both normal gravity (1 g) and reduced gravity (0 g) environments; the specimens were burned in various quiescent mixtures of oxygen, helium, argon, and nitrogen. A correlation for normal gravity and reduced gravity burning was obtained based on theoretical models of previous investigators. Author

N76-24507# Technische Hogeschool, Delft (Netherlands). Dept. of Mechanical Engineering.

AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF A CONSTRUCTION ON TURBULENT PIPE FLOW

R. C. D. Lissenburg, J. O. Hinze, and H. Leydens Oct. 1975 36 p refs

(WTHD-76) Avail: NTIS HC $4.00

Measurements were made of the distributions of the mean velocity and the axial turbulence velocity component in a cross section of a circular tube at various distances downstream from a number of different constrictions. These constrictions had a contraction ratio of 0.25. One of the constrictions was made of a thin rubber hose. When the contraction ratio was reduced to a value smaller than 0.25, self-excited vibrations of the hose took place, producing an oscillating flow of the air in the tube. The Reynolds number was kept at roughly 5,000. Spectral distributions of the turbulence velocity were measured in the axis of the tube and in a point very close to the wall. After 40 tube diameter distance downstream from the constrictions an almost complete recovery of the disturbed turbulent flow, as far as the distributions of mean velocity and relative turbulence intensity are concerned, was obtained. The spectral distributions showed in some cases a difference with the undisturbed case, in particular in the low frequency range. If the flexible constriction was vibrating, the induced oscillations of the flow which showed up as discrete peaks in the spectral distributions, persisted over the entire length of the tube. Author

N76-24508# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

THRESHOLD OF CAVITATION IN ORIFICES

S. D. Harris 1975 23 p refs Presented at the Ann. Meeting of ASME, Houston, Tex.

(Contract AT(07-2)-1)

(DP-MS-75-15; Conf-751106-9) Avail: NTIS HC $4.25

Conditions were determined at which limited cavitation begins (vapor bubbles at edge of orifice) in sharp- and square-edged orifices. Tests were conducted with water at 18 to 80 C and downstream pressures from 34.5 to 550 kPa. Piping diameters were 5, 7, 10, 45.7, and 60 cm, with orifice-to-pipe diameter ratios from 0.18 to 0.75. In all tests except those with 60-cm piping, a window or clear section was provided downstream for visual observation of cavitation. The possibility of reducing the degree of cavitation while maintaining a given pressure loss by various orifice modifications was investigated. Data illustrating cavitation and vibration characteristics of the various orifices are presented. Author (ERA)

N76-24509# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

EXPERIMENTAL INVESTIGATION OF SOUND-AFFECTED FLAME AND GAS JET FLOW AROUND BODIES [EXPERIMENTELLE UNTERSUCHUNG DER ANSTROEMUNG VON KOERPERN DURCH SCHALLBEEINFLUSSTE FLAMMEN- UND GASFREISTRAHLEN]

Peter E. M. Schneider and Dietrich Rapp May 1975 92 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft (Rept-2/1975) Avail: NTIS HC $5.00

The vortex structure of burning and nonburning free jets affected by sound was investigated for flow around certain types of bodies. The additional boundary conditions presented by the bodies perturbs the turbulent jets in such a manner that resulting variations provide information on their structure. The variations in the irradiating sound induced by the jet flow were observed in the far field. Two complementary bodies were used: an infinite plate normal to the flow and a conical cylinder axial in flow direction. The flow sound spectra were observed as a function of body distance from nozzle exit, gas flux, and the exciting flux amplitude. Measurements were also carried out for a circular disk. ESA

N76-24510# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

MORPHOLOGIC SIMILARITY OF VORTEX TRANSFORMATION/DROP TRANSFORMATION AND VORTEX JET/DROP JET [MORPHOLOGISCHE AEHNLICHKEIT VON WIRBELUMBILDUNG/TROPFENUMBILDUNG UND WIRBELSTRAHL/TROPFENSTRAHL]

Peter E. M. Schneider Aug. 1975 79 p refs In GERMAN (Rept-9/1975) Avail: NTIS HC $5.00; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 36.90

The following processes are shown to have a morphologic similarity: formation of single vortex/single drop and vortex/drop jet, relaxation process of perturbations leading to vortices/drops jet, oscillation of single vortex/single drop and vortex/drop jet, transformation of single vortex/single drop and vortex/drop jet, vortex/drop fusion, and vortex/drop separation. This morphologic similarity is based on the fact that in the case of vortex and vortex jets the vortex self-induction and the induction between vortices and in the case of drops and drop jets the surface tension induce an analog behavior of vortex/vortex jet and drop/drop jet. ESA

N76-24511# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Theoretische Aerodynamik.

MIXING OF PERPENDICULARLY IMPINGING JETS WITH DIFFERENT VELOCITY AND TEMPERATURE IN A PIPE [VERMISCHUNG SENKRECHT AUFEINANDERTREFFENDER STRAHLEN VERSCHIEDENER GESCHWINDIGKEIT UND TEMPERATUR IN EINEM ROHR]

S.R. Ahmed Nov. 1975 21 p refs In GERMAN

(DLR-IB-151-75/19) Avail: NTIS HC $3.50

The turbulent mixing in a pipe of air jets with different temperatures was experimentally investigated. The test was so arranged that cold secondary jets were injected into a hot air jet. The secondary jets impinged perpendicularly on the main jet by means of several circular borcholes equally distributed over the circumference of the pipe. The effects of the following parameters on the velocity and temperature equalizing length was investigated: velocity ratio, temperature ratio, and area ratio of the jets and the number of secondary jet borcholes. The equalizing length is the length of the mixing chamber necessary to reduce the original unevenness of the velocity or the temperature of the mixing jets to a predefined measure. ESA

N76-24512# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.

VELOCITY AND TEMPERATURE DISTRIBUTION IN THE FREE JET OF A ROCKET ENGINE [BERICHT UEBER DIE GESCHWINDIGKEITS- UND TEMPERATURVERTEILUNG IM FREISTRAHL EINES RAKETENTRIEBWERKES]

R. Zocher, H. Warntjes, and W. Buschulte 1974 20 p ref In GERMAN Presented at the Symp. of the Carl Cranz Ges. on Flugkoerperantriebe, Brunswick, 11-15 Mar. 1974

(DLR-IB-456-75/4) Avail: NTIS HC $3.50

A theory was developed and calculations carried out to determine the velocity and temperature distribution of rocket exhaust jets. The exhaust jet is a hot hypersonic jet diverging from the conical nozzle. The nozzle exhaust pressure is generally not adapted to the ambient pressure. These effects lead to an overshoot and an over expansion of the jet after emerging from the nozzle. It is assumed that the initial state of the free jet flow field is given by the cross section in which the overshooting jet has its largest cross section and thus its highest velocity. The comparison of theoretical and calculation values shows this assumption to be correct. ESA

N76-24513# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

CRITICAL REVIEW OF STAGNATION POINT HEAT TRANSFER THEORY Final Report, 15 Jan. - 15 Jul. 1975

H. Hoshizaki, Y. S. Chou, N. G. Kulgein, and J. W. Meyer Jul. 1975 110 p refs

(Contract F33615-75-C-3032; AF Proj. 1426)

(AD-A018885; AFFDL-TR-75-85) Avail: NTIS CSCL 20/13

The discrepancy between the bulk enthalpy obtained from an arc chamber heat balance and the test section bulk enthalpy derived from stagnation point heat transfer measurements is investigated. Free stream turbulence is a possible cause of discrepancy. Copper particle impingement may also be a possible cause if the copper mass loading is greater than 0.1%. Enthalpy fluctuations, radial enthalpy gradients, chemical nonequilibrium, swirl flow, and transport property uncertainties were all found to be unimportant. Author (GRA)

N76-24514# ARO, Inc., Arnold Air Force Station, Tenn.
MIXED FREE AND FORCED CONVECTION COOLING IN A LONG SLENDER TUBE WITH INLET EFFECTS Final Report, Feb. - Jul. 1974
Frederick L. Shope AEDC Dec. 1975 37 p refs
(ARO Proj. V37A-32A)
(AD-A018653; ARO-VKF-TR-75-72; AEDC-TR-75-142) Avail: NTIS CSCL 13/1

Results are presented concerning an experimental study of mixed free and forced convection cooling of a long slender tube where the inlet is a high-speed jet which severely disrupts the normally expected boundary layer or free convection development. The similarity parameter GR/Re to the 2nd power ranged from 10 to 100, which would suggest free convection dominance were it not for the inlet jet. In contrast to most heat-transfer experiments, the tube was insulated from its external environment and its temperature was allowed to vary axially, circumferentially, and temporally in order to study the gradients induced in the tube by the free-forced convection process. The resulting rate of cooling of the tube was measured. Timewise and spatial temperature variation of both the tube and cooling air are presented for various pressure levels up to 28 atmospheres at nominally constant flow rates of 0.3 to 0.4 lb/sec. Heat-transfer coefficients derived from these data are found to be two to five times greater than anything expected from the classical Nusselt number relations. A physical model based on buoyant effects opposed by a convected decaying jet turbulence is correlated with the experimental results. Author (GRA)

N76-24515# ARO, Inc., Arnold Air Force Station, Tenn.
RAYLEIGH SCATTERING STUDIES OF CO2 EXPANSION FLOW FIELDS Final Report, 1 Jul. 1974 - 30 Jun. 1975
W. D. Williams and J. W. L. Lewis AEDC Dec. 1975 27 p refs
(ARO Proj. V32S-51A)
(AD-A019386; ARO-VKF-TR-75-104; AEDC-TR-75-146; AFRPL-TR-75-61) Avail: NTIS CSCL 07/4

Sonic orifice expansions of CO2 were investigated using laser Rayleigh scattering for detection of condensation onset within the expansion flow field. The axial region studied was 0.8 to 60 orifice diameters downstream of the orifice, and a range of reservoir pressures was employed for expansions of CO2 at ambient temperature. Two sonic orifice sources, 1.325- and 3.2-mm diameter, were studied for the purpose of determining the appropriate reservoir scaling laws for condensation onset and growth. Rayleigh scattering intensities are presented as a function of axial distance and reservoir pressure, and the results clearly show the regions of condensation onset and growth. GRA

N76-24516# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.
THE VISCID-INVISCID INTERACTION ASSOCIATED WITH A TWO DIMENSIONAL TRANSONIC FLOW PAST A BACK STEP Final Report, 1 Oct. 1974 - 30 Sep. 1975
W. L. Chow and T. S. Shih Oct. 1975 49 p refs
(Contract DAHC04-75-G-0041)
(AD-A018640; ME-TR-395-3; UILU-ENG-75-4003; ARO-12849.1-R-E) Avail: NTIS CSCL 20/4

The problem of viscid-inviscid interaction associated with separated flows within the transonic flow regime is examined. A flow model is developed to account for this interaction for a transonic flow past a backstep. By specifying an unknown discrete parameter which essentially describes the equivalent inviscid flow geometry within the separated flow region, the corresponding inviscid flow field is established through numerical relaxative calculations of the full potential equation. It has been found in the subsequent viscous flow calculations that the point of reattachment behaves as a saddle point singularity for the system of equation for the viscous flow within the recompression region which, in turn, provides a discriminating condition for the determination of the discrete parameter. GRA

N76-24517# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
WALL TEMPERATURE EFFECTS ON LAMINAR WAKES Final Technical Report, 1 Nov. 1973 - 30 Jun. 1975
Ali Reza Ahmadi, , and M. Finston Jul. 1975 68 p refs
(Contract F44620-74-C-0025)
(AD-A019530; TR-191; AFOSR-75-1634TR) Avail: NTIS CSCL 20/4

An experimental investigation was made of the effects of cold wall conditions on the structure of the laminar near wake of a 7 degree half-angle right circular cone with a sharp nose at zero pitch and yaw. Free stream Mach number and Reynolds number were M=6.3 and Re=112,500 per inch. The cone was supported by a five-degree-of-freedom magnetic model suspension system. Measurements of pitot pressure and the recovery temperature of a cylindrical hot film were made in the region extending from the model base to five base diameters downstream. A time-dependent method was used in which the data were taken while an initially cold model slowly warmed up to adiabatic condition. Author (GRA)

N76-24518# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
THE MOTION OF ELLIPSOIDAL PARTICLES IN A VISCOUS SHEAR FLOW. I: THE FIRST-ORDER SOLUTIONS
I-Dee Chang Apr. 1975 45 p refs
(Contract DAHC04-73-C-0034)
(AD-A018889; SUDAAR-492; ARO-11032.2-E) Avail: NTIS CSCL 20/4

The slow gyration of an ellipsoid in a shear flow is studied by a singular perturbation method. The aim of the investigation is to examine the nonlinear effect of the fluid on the orbit of gyration. The small parameter used in the analysis is the shear Reynolds number. GRA

N76-24519# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
IDEAL FLOW OVER ARBITRARY BODIES AND BETWEEN PARALLEL WALLS SOLVED BY THE FINITE ELEMENT METHOD AND GALERKIN'S INTEGRAL
Troy A. Street Aug. 1975 34 p refs
(DA Proj. 1M3-62303-A-214)
(AD-A018991; RD-76-14) Avail: NTIS CSCL 20/4

A detailed formulation of the finite element method for inviscid, incompressible flow over arbitrary bodies between parallel walls has been conducted. The formulation involved triangular and quadrilateral elements. The solutions obtained using different shapes and numbers of elements are compared. A cursory state-of-the-art examination of the finite element method with a view toward current and future fluid dynamic problems was conducted. GRA

N76-24520# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics And Astronautics.
ANISOTROPIC RADIATIVE TRANSFER IN GAS DYNAMICS Interim Technical Report
James B. Elgin Oct. 1975 283 p
(Contract F44620-75-C-0040; MIT Proj. OSP-82450; AF Proj. 978103)
(AD-A019529; TR-75-2; AFOSR-75-1564TR) Avail: NTIS CSCL 20/4

The classical differential formulation of radiative transfer in a gray gas is reevaluated for the condition of arbitrary anisotropy of the intensity distribution. A sectional ellipsoidal model is developed, and used to provide a spatially varying closure condition for the radiation moment equations, valid for arbitrary anisotropy. The model is further used to provide equally applicable boundary conditions. The approach is applied in several examples of pure radiative transfer for gases within straight walled, cylindrical and conical enclosures. Singularities arising in the analysis are identified, the numerical methods for treating them are presented.

Application of the ellipsoidal model is made to the radiatively coupled hypersonic flow over a wedge. Differences between the solution are discussed. GRA

N76-24521# Naval Academy, Annapolis, Md. Energy-Environment Study Group.
HEAT TRANSFER MODIFICATION THROUGH BOUNDARY LAYER CONTROL
William E. Fasnacht 1 Aug. 1975 21 p refs
(AD-A019231; USNA-EPRD-14) Avail: NTIS CSCL 20/4

The possibility of conserving energy through controlling the air boundary layer thickness at a window was studied. Conduction through the air boundary layer was found to account for less than 40% of the energy arriving/departing the window surfaces, with the remainder via thermal radiation. GRA

N76-24522# TRW Systems Group, Redondo Beach, Calif.
WAKE MODELING STUDIES Final Report, 15 Aug. 1971 - 31 Jul. 1975
E. Baum Jul. 1975 12 p refs
(Contract N00014-72-C-0074; ARPA Order 1910)
(AD-A018671; TRW-20086-6014-RU-00) Avail: NTIS CSCL 20/4

This report summarizes work performed in the development of a code for predicting the disturbance generated by a submerged moving body in a generally stratified medium. Details of this work have been documented separately. Author (GRA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-24523* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH TEMPERATURE STRAIN GAGE CALIBRATION FIXTURE Patent
Thomas Vranas, inventor (to NASA) Issued 18 May 1976 16 p Filed 19 Dec. 1974 Supersedes N75-13227 (13 - 04, p 0418)
(NASA-Case-LAR-11500-1; US-Patent-3,956,919; US-Patent-Appl-SN-534266; US-Patent-Class-73-1B; US-Patent-Class-73-15.6) Avail: US Patent Office CSCL 14B

An apparatus and method are described for calibrating high temperature strain gases which serve for both dead weight and constant deflection measurements. A cantilever support arm allows the test unit to slide into a furrface while one end is subjected to bending strain either by hanging weights upon it or by deflecting it with a push rod. The dual nature of the fixture permits both tests to be run without change of the test specimen or removal from the furnace. Official Gazette of the U.S. Patent Office

N76-24524* National Aeronautics and Space Administration. Pasadena Office, Calif.
WIND SENSOR Patent
James B. Stephens (JPL) and Eric G. Laue, inventors (to NASA) (JPL) Issued 18 May 1976 30 p Filed 29 Jan. 1975 Supersedes N75-16807 (13 - 08, p 0886) Sponsored by NASA
(NASA-Case-NPO-13462-1; US-Patent-3,956,932; US-Patent-Appl-SN-545282; US-Patent-Class-73-189; US-Patent-Class-73-204) Avail: US Patent Office CSCL 14B

An apparatus is described for sensing the temperature, velocity, and direction of the wind, including four temperature-dependent crystal oscillators spaced about an axis, a heater centered on the axis, and a screen through which the wind blows to pass over the crystals. In one method of operation, the frequency of the oscillators is taken when the heater is not energized, to obtain the temperature of the wind, and the frequencies of the oscillators are taken after the heater is energized to determine the direction and velocity of the wind. When the heater is energized, the wind causes the downwind crystals to achieve a higher temperature than the upwind crystals, and with the magnitude of the difference indicating the velocity of the wind. Official Gazette of the U.S. Patent Office

N76-24525* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
READOUT ELECTRODE ASSEMBLY FOR MEASURING BIOLOGICAL IMPEDANCE Patent
Leslie D. Montgomery (NAS-NRC) and Dwight L. Moody, Jr., inventors (to NASA) (NAS-NRC) Issued 18 May 1976 17 p Filed 24 Feb. 1975 Supersedes N75-18536 (13 - 10, p 1109) Sponsored by NASA
(NASA-Case-ARC-10816-1; US-Patent-3,957,037; US-Patent-Appl-SN-552454; US-Patent-Class-128-2.1E; US-Patent-Class-128-2.05V; US-Patent-Class-128-2.1Z; US-Patent-Class-128-DIG.4) Avail: US Patent Office CSCL 14B

The invention comprises of a pair of readout ring electrodes which are used in conjunction with apparatus for measuring the electrical impedance between different points in the body of a living animal to determine the amount of blood flow therebetween. The readout electrodes have independently adjustable diameters to permit attachment around different parts of the body between which it is desired to measure electric impedance. The axial spacing between the electrodes is adjusted by a pair of rods which have a first pair of ends fixedly attached to one electrode and a second pair of ends slidably attached to the other electrode. Indicia are provided on the outer surface of the ring electrodes and on the surface of the rods to permit measurement of the circumference and spacing between the ring electrodes. Official Gazette of the U.S. Patent Office

N76-24526 British Library Lending Div., Boston Spa (England).
APPLICATION OF THE SCANNING ELECTRON MICROSCOPE WITH AN ENERGY DISPERSED X-RAY SPECTROMETER FOR STUDYING SODIUM CORROSION AND MASS TRANSFER
H. V. Borgstedt and H. J. Huber Nov. 1975 28 p refs Transl. into ENGLISH from unknown origin report KFK-2137, Mar. 1975
(BLL-Dounreay-Tran-698(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

The scanning electron microscope is an instrument useful for the detection of morphological and chemical changes in material surfaces due to sodium corrosion and mass transfer. Some examples for the application of the scanning microscope in combination with the X-ray spectrometer are presented. The capacity of the method to observe corrosion phenomena is discussed. Author

N76-24527 Tennessee Univ., Knoxville.
FUNDAMENTAL PROPERTIES OF HOLOGRAPHICALLY RECONSTRUCTED IMAGES Ph.D. Thesis
Reinhard Wolfgang Menzel 1975 162 p
Avail: Univ. Microfilms Order No. 76-11071

The fundamental characteristics of images obtained by holographic reconstruction are presented. These characteristics are discussed in terms of a holographic reconstruction model based on scalar diffraction theory. The model is used to derive the point and line spread functions and the images of a few experimentally important objects which have analytical solutions. The properties which characterize the details of a reconstructed image are shown to be multiparametric functions. The parameters which most significantly influence the resolution and the intensity within the image are shown to be the object-to-reference beam intensity ratio and the hologram size. Some holographic system spread functions are experimentally obtained, and the results are compared with the theoretical model and with experimentally observed resolution characteristics. Dissert. Abstr.

N76-24528*# Scientific Translation Service, Santa Barbara, Calif.
AN AIRBORNE SUBMILLIMETER RADIOMETER WITH REMOVABLE SPECTRAL FILTERS FOR THE STUDY OF ATMOSPHERIC EMISSIONS IN THE 50 - 1000 MICRON REGION
V. D. Gromov, G. B. Sholomitskiy, V. A. Soglasnova, and V. V.

Artamonov Washington NASA Jun. 1976 11 p refs Transl. into ENGLISH of 'Samoletnyy submillimetrovyy radiometr so smennymi spektralnymi filtrami dlya issledovaniya emissii atmosfery v oblasti 50 -1000 mkm', Rept. Pr-250 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1975 12 p
(Contract NASw-2791)
(NASA-TT-F-17055) Avail: NTIS HC $3.50 CSCL 14B

A description is given of the flight test of a radiometer with removable spectral filters. This radiometer made it possible to obtain the spectral and angular distribution of the atmospheric radiation temperature. The equipment is illustrated in figures and discussed in detail. Author

N76-24529*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HYBRID HOLOGRAPHIC NON-DESTRUCTUVE TEST SYSTEM Patent Application
Robert L. Kurtz, inventor (to NASA) Filed 14 May 1976 23 p
(NASA-Case-MFS-23114-1; US-Patent-Appl-SN-686331) Avail: NTIS HC $3.50 CSCL 14B

An automatic hybrid holographic nondestructive testing (HNDT) method and system capable of detecting flaws or debonds contained within certain materials is described. This system incorporates the techniques of optical holography, acoustical/optical holography, and holographic correlation in determining the structural integrity of a test object. An automatic processing system including a detector and automatic data processor is used in conjunction with the three holographic techniques for correlating and interpreting the information supplied by the nondestructive systems. The automatic system also includes a sensor which directly translates an optical data format produced by the holographic techniques into electrical signals and then transmits this information to a digital computer for indicating the structural properties of the test object. The computer interprets the data gathered and determines whether further testing is necessary. NASA

N76-24530*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PSEUDO-BACKSCATTER LASER DOPPLER VELOCIMETER EMPLOYING ANTIPARALLEL REFLECTOR IN THE FORWARD DIRECTION Patent Application
William D. Gunter, Jr., inventor (to NASA) Filed 27 May 1976 18 p
(NASA-Case-ARC-10970-1; US-Patent-Appl-SN-691046) Avail: NTIS HC $3.50 CSCL 14B

The laser Doppler velocimeter measures localized fluid velocity by employing a reflector in the forward direction which reflects scattered radiation in an antiparallel direction back to a collector. The collector provides a frequency modulated signal representative of the velocity of the fluid at the predetermined location. NASA

N76-24531# Siemens A.G., Munich (West Germany). Hauptgebiet Zentrale Fertigungsaufgaben.
NEW PRODUCTION TEST AND MEASUREMENT TECHNOLOGIES Final Report
Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 179 p refs In GERMAN; ENGLISH summaries Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-30) Avail: NTIS HC $7.50; ZLDI, Munich DM 37.60

Results of three different research projects in production testing and measurement are reported. Investigations in the fields of holographic interferometry and laser speckle photography are described. The principles of a device based on laser light diffraction for measuring diameters of thin wires are presented. Developments in computer-aided electronic image converter systems for production line precision measurements are surveyed. Investigations concerning procedures for checking the accuracy of machine tools or other coordinate controlled production equipment are reviewed, with particular attention paid to laser Doppler interferometry. For individual titles, see N76-24532 through N76-24534.

N76-24532 Siemens A.G., Munich (West Germany).
DEVELOPMENT OF HOLOGRAPHIC AND DIFFRACTION OPTICAL METHODS OF MEASUREMENT [ENTWICKLUNG HOLOGRAPHISCHER UND BEUGUNGSOPTISCHER VERFAHREN FUER DIE MESSTECHNIK]
Ulrich Koepf *In its* New Production Test and Meas. Technol. Dec. 1975 p 9-61 refs In GERMAN; ENGLISH summary (For availability see N76-24531 15-35)

Results of investigations conducted mainly in the field of holographic interferometry and laser speckle photography are described. Experimental setups and techniques as well as numerous applications are given. The principles of a device based on laser light diffraction for measuring diameters of thin wires are presented. Author (ESA)

N76-24533 Siemens A.G., Munich (West Germany).
DEVELOPMENT OF A COMPUTER AIDED OPTO-ELECTRONIC IMAGE CONVERTER SYSTEM FOR APPLICATION TO MEASUREMENT OF MECHANICAL PARAMETERS [ENTWICKLUNG OPTO-ELEKTRONISCHER BILDWANDLERSYSTEME FUER DEN EINSATZ IN DER MESSTECHNIK MECHANISCHER GROESSEN IN VERBINDUNG MIT DV-ANLAGEN]
Gerfried Kohl, Dieter Maerz et al *In its* New Production Test and Meas. Technol. Dec. 1975 p 62-140 refs In GERMAN; ENGLISH summary (For availability see N76-24531 15-35)

Developments in computer-aided image processing systems for measurements in the industrial production line are reported. Three types of instruments were investigated and tested in particular: electronic precision microscope with computerized data acquisition and data processing using an industrial TV camera as a converter, optoelectronic magnifying glass with digital display using an integrated photodiode strip as a converter, and an optoelectronic sighting device with a position sensitive photodiode for automation of position and distance measurements in coordinate measurement. ESA

N76-24534 Siemens A.G., Munich (West Germany).
DEVELOPMENT OF METHODS FOR TESTING THE ACCURACY OF COORDINATE CONTROLLED PRODUCTION EQUIPMENT [ENTWICKLUNG VON VERFAHREN ZUR UEBERPRUEFUNG DER GENAUIGKEIT VON KOORDINATENGESTEUERTEN FERTIGUNGSEINRICHTUNGEN]
Wolfgang Fischer and Dietmar Mangelsdorf *In its* New Production Test and Meas. Technol. Dec. 1975 p 141-179 refs In GERMAN; ENGLISH summary (For availability see N76-24531 15-35)

Results of investigations concerning procedures for checking the accuracy of machine tools or other coordinate equipment used in production are reported. Characteristic accuracy values are defined and the measuring techniques are described. In particular a method for determining position uncertainty using laser Doppler interferometry is detailed. ESA

N76-24535# Oak Ridge National Lab., Tenn.
VERSATILE PARTICLE SIZE ANALYZER
G. Golberg and D. A. Costanzo Nov. 1975 27 p
(Contract W-7405-eng-26)
(ORNL-TM-5157) Avail: NTIS HC $4.00

A particle size analyzer was developed which employs the Coulter technique for the measurement. The analyzer consists of a Coulter metering assembly, constant current supply, pulse height analyzer, and a data handling module. The Coulter technique is a method of determining the number and size of particles suspended in an electrolyte by causing them to pass through a small orifice on either side of which an electrode is immersed. The changes in resistance as particles pass through the orifice generate voltage pulses whose amplitudes are proportional to the volumes of the particles. The pulses are amplified, sized, and counted, and from the derived data the size distribution of the suspended phase may be determined. Analysis may be carried out rapidly and with good reproducibility. Author (ERA)

N76-24536# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
INTERFERENCE HOLOGRAPHY: A MEANS FOR NON-DESTRUCTIVE TESTING
Rob J. Schliekelmann 20 Sep. 1974 28 p
(FOK-K-80) Avail: NTIS HC $4.00

The use of laser interference holography to show relative displacements in the direction of the observer with an order of

magnitude of one quarter wave length of the light used (0.13 to 0.16 microns) is discussed. Detection of defects in solid materials requires rather high stress in the plane perpendicular to the direction of observation. Thin walled structures in the form of pressure vessels, pipes, and adhesive bonded structures can be effectively inspected by interference holography on defects as well as for study of their resonance characteristics.
Author (ESA)

N76-24537# Institut Franco-Allemand de Recherches, St. Louis (France).
SURFACE TEMPERATURE OF RODSHAPED PROJECTILES AFTER PERFORATING AN ARMOR PLATE [OBERFLAECHENTEMPERATUR VON STABGESCHOSSEN NACH DURCHSCHLAGEN EINER PANZERPLATTE]
H. Mach Bonn DOKZENTBw 1975 24 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung (BMVg-FBWT-75-7) Avail: NTIS HC $3.50; DOKZENTBw DM 30

Rodlike tungsten projectiles and tungsten alloy projectiles were fired through 25 mm thick armorplates at velocities between 1100 and 1600 m/s by means of a 20 mm caliber gun. In the perforation process deformation causes parts of the projectile to heat up so that they become luminous. The surface temperature of the projectile head was determined starting from the spectral emission ranging from the visible to the near infrared region. At v = 1200 m/s, a peak temperature of 2300 K was observed in the case of tungsten. A slight increase in temperature was observed with increasing impact velocity. It was possible to evaluate the part of thermal energy with respect to the whole residual energy. Author (ESA)

N76-24538# Siemens A.G., Karlsruhe (West Germany). Abteilung Systemtechnische Entwicklung.
ELECTRON SPECTROMETRY FOR CHEMICAL ANALYSIS (ESCA) Final Report [ELEKTRONENSPEKTROMETRIE FUER CHEMISCHE ANALYSEN (ESCA)]
Norbert Weichert and Dieter Kuehn Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 58 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. (BMFT-FB-T-75-24) Avail: NTIS HC $4.50; ZLDI, Munich DM 12,20

The ESCA system, its components, and functions are described. Essentially two versions of the electronic part of an ESCA instrument were designed and constructed as experimental models, one as a manually operated system, the other as an automated system controlled by a mini-computer. Two different X-ray sources and a novel type of electron spectrometer were developed and tested. Features and performance of the computer program, which is used with the automated system, are also presented. Author (ESA)

N76-24539# Institut Franco-Allemand de Recherches, St. Louis (France).
AVERAGE OPERATOR. PART 1: THEORY IN VIEW OF AERODYNAMICAL APPLICATIONS [OPERATEUR DE MOYENNE. PARTIE 1: ETUDE THEORIQUE EN VUE D'APPLICATIONS AERODYNAMIQUES]
L. R. Oudin 30 Apr. 1974 52 p refs In FRENCH
(ISL-14/74) Avail: NTIS HC $4.50

Using the Foucault Schlieren method it is possible to recover the distribution of volumic masses from the photographic recordings or a gaseous phase object if the distribution is cylindrical. This corresponds to using the ABEL integral. It is shown how a set of schlieren recordings allows, via an average operator, recovery of the volumic mass distribution of a gaseous phase object limited in space no longer subjected to the provisions of cylindrical distribution. The mathematical solution of this problem is shown to be extendable to holography, interferometry, X-ray tomography, and plasma physics. ESA

N76-24540# Institut Franco-Allemand de Recherches, St. Louis (France).
AVERAGE OPERATOR. PART 2: APPLICATIONS [OPERATEUR DE MOYENNE. PARTIE 2: APPLICATIONS PRATIQUES]
L. R. Oudin 30 Apr. 1974 57 p refs In FRENCH
(ISL-15/74) Avail: NTIS HC $4.50

A numerical method for reproduction of X-ray absorption coefficients in a three-dimensional object is presented. A series of radiographs are taken through 180 deg rotation of the object. From these radiographs the absorption coefficients were determined using the method of the average operator. The formulation of the problem in mathematical terms is detailed together with the experimental setup. The algorithm for the average operator is presented. Applications of the algorithm to eigen function and disk functions are performed. The various causes of precision degradation are discussed. The relative precision is 1 part per 10,000 to 1 part per 1,000,000 for analytical examples with continuous derivatives. A sudden slope change in the radiographs is shown to indicate significant numerical instabilities. ESA

N76-24541# Institut Franco-Allemand de Recherches, St. Louis (France).
INVESTIGATIONS ON FAST GAS FLOWS WITH THE LASER ANEMOMETER [UNTERSUCHUNGEN AN SCHNELLEN GASSTROEMUNGEN MIT DEM LASER-ANEMOMETER]
B. Koch, H. J. Pfeifer, and H. J. Schaefer 27 Feb. 1975 11 p In GERMAN Presented at the Deut. Physik. Ges. Working Group Meeting 'Quantenoptik', Cologne, 24-27 Feb. 1975
(ISL-CO-204/75) Avail: NTIS HC $3.50

The capabilities and limits of the laser Doppler velocimeter method are discussed with regard to its application to fluid and gas dynamics. An introduction is given to the physical principles of the instrumentation, and some results of velocity and turbulence measurement in hypersonic wind tunnels and free jets are described. ESA

N76-24542# Institut Franco-Allemand de Recherches, St. Louis (France).
HOLOGRAPHIC MEASUREMENT OF MICROPARTICLE VELOCITIES [LA MESURE DES VITESSES DES MICROPARTICULES PAR HOLOGRAPHIE]
H. Royer 24 Feb. 1975 29 p refs In FRENCH
(ISL-R-107/75) Avail: NTIS HC $4.00

Double exposure techniques in GABOR setup are used for microparticle velocity measurement. Experiments were performed with particles suspended in an air flow of 100 m/s velocity. Results are in agreement with computer based forecasts. The measurement quality and technical limitations are evaluated; proposals for improvement are presented. ESA

N76-24543# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Grafische Datenverarbeitung und Strukturerkennung.
EXPERIENCES WITH THE DIGITALIZATION OF GRID RECORDED LINE STRUCTURES, PART 1 [ERFAHRUNGEN MIT DER DIGITALISIERUNG VON RASTERMAESSIG ERFASSTEN LINIENSTRUKTUREN, TEIL 1]
Thomas Kreifelts, Karl Pick, Peter Wisskirchen, and Gerd Woetzel 1974 43 p refs In GERMAN
(GMD-Mitt-30) Avail: NTIS HC $4.00

The digitalization of line structures, which are recorded using grids, is discussed. The ACSD scanner system at the Rome Air Development Center in Rome, U.S., was used to grid record contour map L5716 at Bad Homburg. The resulting binary matrix was further processed at the Institute for Processing of Graphical Data and of Structure Recognition of the Society for Mathematics and Data Processing. The following is discussed: line tracking, including skeletonizing, labeling and branch solving, processing time; data reduction and data organization. ESA

N76-24544# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
EFFECT OF BLURRED EDGES ON THE PARTICLE SIZE DETERMINATION IN HIGH SPEED PHOTOGRAPHY [EINFLUSS DER RANDUNSCHAERFEN AUF DIE TEILCHENGROESSENBESTIMMUNG IN DER KURZZEITFOTOGRAPHIE]
R. Furchert [1975] 27 p In GERMAN
(DLR-IB-456-75/3) Avail: NTIS HC $4.00

Edge blurring in high speed photography of dynamic particle fields, e.g. spray droplets, is of a complex nature. Essentially, this results from a superposition of effects produced

by a non-point light source. Improvements can be obtained by adjusting the diaphragm; at the cost of loss of sufficient illumination. The errors show up only on positive enlargements. Photography using a laser light source shows a quality improvement. ESA

N76-24545# Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).
STUDY OF A REAL-TIME CONVERTER OF AN INCOHERENT IMAGE INTO A TRANSPARENCY (OPTICAL TO OPTICAL CONVERTER)
F. Holdermann, A. Huber, and H. Kazmierczak Nov. 1975 245 p refs
(Contract ESTEC-2342/74-HP)
(ESA-CR(P)-795) Avail: NTIS HC $8.00

The feasibility of realizing an incoherent-to-coherent-optical converter to be used in conjunction with an optical processor for satellite missions was investigated. The requirements of components are specified, based on their application in incoherent-to-coherent-optical converters for optical processors. Image processing aspects are considered as well as aspects arising from operating conditions in satellites. The physical properties of components for converter realization found in literature are described and assessed. Two components were studied in detail: a Poekels Readout Optical Modulator device and liquid crystal cells. Investigations concerned the electro-optical properties of liquid crystals alone and photoconductor-liquid crystal sandwich structures. Author (ESA)

N76-24546*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SYSTEM FOR EXTRACTING 3-DIMENSIONAL MEASUREMENTS FROM A STEREO PAIR OF TV CAMERAS
Y. Yakimovsky and R. Cunningham 15 May 1976 19 p refs
(Contract NAS7-100)
(NASA-CR-147149; JPL-TM-33-769) Avail: NTIS HC $3.50 CSCL 14E

Obtaining accurate three-dimensional (3-D) measurement from a stereo pair of TV cameras is a task requiring camera modeling, calibration, and the matching of the two images of a real 3-D point on the two TV pictures. A system which models and calibrates the cameras and pairs the two images of a real-world point in the two pictures, either manually or automatically, was implemented. This system is operating and provides three-dimensional measurements resolution of + or - mm at distances of about 2 m. Author

N76-24547# Ohio State Univ., Columbus. ElectroScience Lab.
A DUAL CHANNEL INFRARED SCANNER FOR ATMOSPHERIC IMAGING STUDIES AT 10.6 MICRONS Final Technical Report
William G. Swarner and Edward K. Damon Griffiss AFB, N. Y. RADC Oct. 1975 77 p refs
(Contract F30602-73-C-0199; ARPA Order 1279; AF Proj. 1279)
(AD-A018788; ESL-3638-2; RADC-TR-75-255) Avail: NTIS CSCL 17/5

A dual channel infrared scanning, display, and recording system originally developed for experiments in atmospheric imaging and image restoration at 10.6 microns has been modified for use with extended targets. Two image formats are now available, one providing two spatially separable images having 40 x 40 element resolution at 200 frames per second and the other, two images having 64 x 64 element resolution at 60 frames per second which may be joined, if desired, to scan a single rectangular image. Visual CRT displays of the infrared images are provided and magnetic tape recordings are made which may be played back later at recording speed or at reduced speed for viewing and to provide computer input for data analysis. This report describes in detail the modifications made to the scanning, display, and recording system and, together with the original report published previously, provides complete documentation for the system. A separate playback, display, and computer interface system, compatible with the scanner system, to be used for image restoration processing has also been developed. Both systems are to be delivered to RADC for infrared imaging and image restoration studies. Author (GRA)

N76-24548# Cincinnati Electronics Corp., Ohio.
INSTRUMENTATION FOR TRACK LIGHT MODIFICATION OF AN/AAR-34 Final Report, Oct. 1974 - Apr. 1975
Jan C. Richmond Wright-Patterson AFB, Ohio AFAL Nov. 1975 15 p
(Contract F33615-75-C-1088; AF Proj. 5616)
(AD-A018796; Rept-80045-AAR25/575; AFAL-TR-75-120) Avail: NTIS CSCL 17/5

Operational experience has shown that the AN/AAR-34 produces an excessive number of short duration IR TGT lamp indications on the AN/APS-109 Indicator Panel. A replacement circuit module, which eliminates these extraneous IR TGT lamp indications by delaying turn-on and turn-off of the Track Light Output signal from the AN/AAR-34 has been developed and fabricated under Contract F33615-74-C-1141. Cincinnati Electronics Corporation installed the improved Track Light Output circuit in the AN/AAR-34 Video Signal Processor and modified the AN/APS-109 Indicator Panel to facilitate a comparative evaluation of the original and improved Track Light Output circuits. Engineering support was provided during the Young Venturo SAC O.T. and E program at Plattsburgh AFB. Following the test program both units were demodified and returned to their original configuration. Author (GRA)

N76-24549# Radio Corp. of America, Princeton, N.J.
SIGNAL/NOISE RATIO OF HOLOGRAPHIC IMAGES Final Report, 24 Jun. - 23 Sep. 1975
W. J. Burke Oct. 1975 32 p refs
(Contract N00019-75-M-0494)
(AD-A018735; PRRL-75-CR-66) Avail: NTIS CSCL 14/5

This report describes the results of the currently obtainable signal/noise (S/N) ratio of images readout from thick phase holograms stored in iron-doped LiNbO3. Using multiple object beam illumination an S/N ratio of approximately 27 db was measured for a white field. No significant decrease in the measured S/N ratio was observed with the increasing number of holograms stored. Author (GRA)

N76-24550# Naval Research Lab., Washington, D.C.
A VERSATILE PASSIVE MICROWAVE IMAGING SYSTEM Interim Report
J. P. Hollinger, J. E. Kenney, and B. E. Troy Nov. 1975 25 p refs
(NRL Proj. G01-10; RR1310343)
(AD-A019173; NRL-MR-3164) Avail: NTIS CSCL 14/2

A new passive microwave imaging system was assembled at the Naval Research Laboratory and flight tested using the NASA/Wallops C-54 aircraft. The system incorporates an oscillating mirror and interchangeable radiometer units making it particularly adaptable to variations in its operational frequency, polarization, and angular resolution. Flight tests of the system have been conducted at 90 GHz and simultaneously at 22 and 31 GHz using a dual frequency radiometer. The imaging system and data processing are described and some of the initial flight test results at 90 GHz are presented. GRA

N76-24551# Utah Univ., Salt Lake City. Dept. of Chemistry.
AUTOMATIC ULTRASONIC ABSORPTION SPECTROMETER
Michael M. Farrow, Steven L. Olsen, Neil Purdie, and Edward M. Eyring 30 Nov. 1975 25 p refs
(Contract N00014-75-C-0796; NR Proj. 051-556)
(AD-A018775; TR-6) Avail: NTIS CSCL 14/2

A completely automatic ultrasonic absorption spectrometer covering the frequency range from 5 MHz to in excess of 250 MHz has been developed. The instrument ultilizes Debye-Sears and Bragg reflection of light to modulate the output of a CW argon-ion laser and is interfaced to a minicomputer that interactively controls experimental parameters and accumulates data. Author (GRA)

N76-24552# Utah State Univ., Logan. Electro-Dynamics Lab.
FAR INFRARED ATMOSPHERIC INSTRUMENTATION AND MEASUREMENTS Final Report, 1 Mar. 1972 - 30 Jun. 1975
Roy W. Esplin, Randy B. Shipley, and Ronald J. Huppi 31 Jul. 1975 56 p refs
(Contract F19628-72-C-0245; AF Proj. 7670)

(AD-A019161; AFCRL-TR-75-0482) Avail: NTIS CSCL 14/2

Infrared Measurement Techniques were improved and developed under this contract. The efforts involved improving an existing interferometer-spectrometer, designing, and constructing an interferometer controller-monitor system, performing feasibility studies of new systems, and designing and constructing a Hadamard grating spectrometer system. Computer design techniques were used to perform much of the work. Measurements and tests were made with the systems, and data reduction was performed as needed. These systems were made for use on board aircraft. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-24553* National Aeronautics and Space Administration. Pasadena Office, Calif.

FIBER DISTRIBUTED FEEDBACK LASER Patent

Charles Elachi (JPL), Gary A. Evans (JPL), and Canour Yeh, inventors (to NASA) (JPL) Issued 18 May 1976 25 p Filed 11 Dec. 1974 Supersedes N75-13243 (13 - 04, p 0420) Sponsored by NASA

(NASA-Case-NPO-13531-1; US-Patent-3,958,188; US-Patent-Appl-SN-531565; US-Patent-Class-331-94.5C; US-Patent-Class-350-96WG) Avail: US Patent Office CSCL 20E

Utilizing round optical fibers as communication channels in optical communication networks presents the problem of obtaining a high efficiency coupling between the optical fiber and the laser. A laser is made an integral part of the optical fiber channel by either diffusing active material into the optical fiber or surrounding the optical fiber with the active material. Oscillation within the active medium to produce lasing action is established by grating the optical fiber so that distributed feedback occurs. Official Gazette of the U.S. Patent Office

N76-24554 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

LASER-INDUCED DAMAGE AS A FUNCTION OF DIELECTRIC PROPERTIES AT 1.06 MU Ph.D. Thesis

Jerry Ray Bettis 1975 127 p

Avail: Univ. Microfilms Order No. 76-10087

Ten dielectric materials in half-wave optically thick films, and eleven uncoated dielectric surfaces were subjected to damaging radiation from a neodymium laser. The threshold optical electric field for damage was determined for each thin-film and uncoated surface. It was demonstrated that the root mean square (rms) surface roughness was important in determining the threshold field for roughnesses ranging from nearly 1,000 A (rms) to less than 10 A (rms). The basic relationship between damage threshold and surface roughness held both for the bare surfaces and for the thin films placed on surfaces with varying roughness. A theoretic-empirical formula was developed which is used to predict threshold fields as a function of material properties, such as refractive index and atomic number density, and surface roughness as well as thin-film material. The relationship holds for a variety of materials in bulk form as well as bare surfaces and thin-film coatings. Agreement between prediction and experiment is generally within twenty percent, the typical experimental accuracy. Dissert. Abstr.

N76-24555 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

MEASUREMENTS OF WATER-VAPOR TRANSITIONS IN THE VICINITY OF 5.35 MU WITH A TUNABLE SPIN-FLIP RAMAN LASER Ph.D. Thesis

William Arthur Wallace 1975 136 p

Avail: Univ. Microfilms Order No. 76-10086

Tunable infrared laser spectroscopy of atmospheric water vapor was carried out at 5.35 microns using a Raman spin-flip laser as a tunable source. Several of the pressure broadened line widths of the 6.3 micron upsilon sub 2 fundamental band of water vapor were measured. The measured line widths were found to be slightly narrower than theoretically calculated widths. These results support other findings and indicate absorption coefficients at the centers that are larger than those indicated by the calculated parameters. These discrepancies have important implications concerning the atmospheric transmittance at or near the water vapor lines measured. Considerable effort went into characterizing the Raman spin-flip laser. Spin-flip scattering from electrons in n-type Indium Antimonide was obtained using a stable single frequency carbon monoxide laser. Stimulated scattering was observed in tellurium doped samples with two different carrier concentrations. Dissert. Abstr.

N76-24556 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

THE EFFECTS OF SURFACE STRUCTURAL PROPERTIES ON LASER-INDUCED DAMAGE AT 1.06 MICROMETERS Ph.D. Thesis

Richard Arthur House, II 1975 152 p

Avail: Univ. Microfilms Order No. 76-10085

An experimental investigation was conducted to determine the correlation between laser-induced breakdown and surface properties in the transparent dielectric materials. The major variables studied were surface structure, surface contamination, polishing techniques, and ultrasonic cleaning. Surface structure included root mean square (RMS) roughness, thin-film dielectric overcoats, and subsurface disorder. Surface contamination was studied by use of two types of polishing compound and by etching. Polishing techniques used were conventional polishing, superpolishing, flame polishing, and ion polishing. The damaging radiation was a focused pulsed laser beam. Results show that: (1) damage threshold strongly correlates with RMS surface roughness, even for the highest quality surfaces (2) threshold is not affected by subsurface disorder (3) thin-film overcoated surfaces (SIO2 and MgFa films) have decreased thresholds (4) flame-polished and ion-polished surfaces have the highest threshold (6) rouge contamination dominates surface structure, and drastically reducing threshold (7) etching with nitric acid increases threshold significantly, and (8) ultrasonic cleaning can drastically change surface structure and threshold. Dissert. Abstr.

N76-24557*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

RESEARCH ON TECHNIQUES FOR LASER RANGING TO OPTICAL CORNER REFLECTORS ON THE MOON. RESEARCH ON LASER TECHNIQUES AND SINGLE PHOTOELECTRON DETECTION AND TIMING Final Report, 1 Jul. 1970 - 30 Sep. 1973

Carroll O. Alley Jun. 1976 12 p refs

(Grant NGR-21-002-285)

(NASA-CR-147154) Avail: NTIS HC $3.50 CSCL 20E

Experimental studies using a pulsed LED, Cerenkov source, and a 100 ps laser were made of various photomultipliers and discriminator combinations. In addition, a new type of neodymium-YAG frequency doubled laser was used as the basis for the development of a stable, short pulse, high repetition rate laser system. This laser was then used in conjunction with atomic clocks to study the effect of gravitational potential on elapsed time. Avenues to promote the development of international cooperation in the area of lunar laser ranging were also explored. D.M.L.

N76-24558# Technische Universitaet, Munich (West Germany). Inst. fuer Allgemeine Elektrotechnik.

DOUBLE HETERO DIODE LASERS [DOPPELHETERODIODENLASER]

J. Heinen and D. Siemsen Bonn DOKZENTBw 1975 70 p refs In GERMAN; ENGLISH summaries Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-75-25) Avail: NTIS HC $4.50; DOKZENTBw DM 30.00

A liquid phase epitaxy installation was constructed for the manufacturing of multiple GaAs or GeAlAs epitaxy layers (heterolayers) to be used as diodes in semiconductor injection lasers. The modulation behavior of injection lasers was investigated at sinusoidal and pulse form excitation. It is shown that the combination of analytical and numerical methods makes it possible to distinguish and select between the various waveforms of the modulated laser light output. For individual titles, see N76-24559 through N76-24560.

N76-24559 Technische Universitaet, Munich (West Germany).
CONSTRUCTION OF A LIQUID PHASE EPITAXY INSTALLATION FOR GaAs AND MANUFACTURING OF LIGHT EMITTING DIODES
In its Double Hetero Diode Lasers 1975 p 1-35 refs In GERMAN; ENGLISH summary (For availability see N76-24558 15-36)

A liquid phase epitaxy installation was constructed for the manufacturing of multiple GaAs or GaAlAs epitaxy layers (heterolayers), to be used as diodes in semiconductor injection lasers, and the influence of some components as quality of substrates, composition of melts, cleaning, temperature, and cooling rate on quality of epitaxial layers was studied. Multilayers with homo and single heterojunction were produced. Light emitting diodes with mesa structure were fabricated from these layers. The geometry of these diodes permits coupling to an optical fiber. Output power and time behavior of these diodes was measured. For diodes with homostructure, speed and power is dependent on the width of the active p-region in contrast to heterojunction diodes. Author (ESA)

N76-24560 Technische Universitaet, Munich (West Germany).
MODULATION CHARACTERISTICS OF SEMICONDUCTOR INJECTION LASERS
In its Double Hetero Diode Lasers 1975 p 36-59 refs In GERMAN; ENGLISH summary (For availability see N76-24558 15-36)

The modulation behavior of injection lasers was investigated at sinusoidal and pulse-like excitation. The transfer functions were calculated and from these the important modulation characteristics modulation factor, modulation efficiency, and resonance frequency - were derived with numerical ones obtained by simulation of the rate equations. It is shown that the combination of the analytical and numerical method makes it possible to distinguish and select between the various wave forms of the modulated laser light output. Author (ESA)

N76-24561# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL INVESTIGATION OF THE PULSED NF3 + H2 CHEMICAL LASER USING A MODEL WHICH INCLUDES ROTATIONAL RELAXATION AND SEMI-CLASSICAL LASER EQUATIONS Ph.D. Thesis
J. R. Creighton 1 Sep. 1975 314 p refs
(Contract W-7405-eng-48)
(UCRL-51931) Avail: NTIS HC $9.75

Waveforms and population distributions were calculated by a numerical model and compared with experiment for the electric-discharge-initiated, pulsed chemical laser. The model treats each vibrational-rotational state separately, allowing rotational relaxation between adjacent states as well as vibrational relaxation and lasing according to P-branch selection rules. Calculated waveforms agree with experiment and show several features not seen when rotational equilibrium is assumed: (1) simultaneous lasing on many transitions, (2) cascade behavior, (3) spikes due to laser relaxation oscillations, (4) nonBoltzmann rotational distributions, and (5) hole burning in the population distributions. The calculations give insight into the physical phenomena governing the shape and duration of the waveforms. The effect of varying certain parameters, relaxation rates, temperature, pressure, and diluents, was studied. The best fit to experimental waveforms is obtained when rotational relaxation rate and collisional line broadening rate are approximately equal at about 10 times the hard sphere collision rate. Author (ERA)

N76-24562# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
COMBUSTION DRIVEN CW HIGH POWER LASERS [VERBRENNUNGSGETRIEBENE CW-HOCHLEISTUNG-SLASER]
H.G. Ruppik 6 Mar. 1975 17 p refs In GERMAN
(DLR-IB-456-75/6) Avail: NTIS HC $3.50

A survey is presented of CW power lasers using exothermal chemical reactions to produce coherent radiation. Two classes of combustion lasers, gas dynamic lasers and chemical mixing lasers are differentiated. Examples are given of lasers working along these principles. ESA

N76-24563# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
CO2 MTI LASER RADAR FOR PERSONNEL AND VEHICULAR DETECTION Final Report, Dec. 1973 - Jul. 1975
Cecil L. Hayes Dec. 1975 63 p ref
(Contract DAAB07-74-C-0063; DA Proj. 1S7-62703-DH-93)
(AD-A018706; C74-77/501; ECOM-75-0063-F) Avail: NTIS CSCL 17/5

This program addressed the design, fabrication, test, and delivery of a developmental CO2 MTI laser radar. The primary goal was the construction of a feasibility model which could be tripod mounted, easily transported in the field, and yet withstand the rigors of field use without performance degradation. Operationally, the main targets of interest were vehicles and personnel within the range of 1.5 km. The equipment fabricated consisted of two units; laser radar head and power supply/control panel. Complete control of the system from a remote location was provided through an umbilical cable. A programmable scanner was furnished which covered a 30 degree field at rates up to 60 degrees/sec, with scan widths from plus or minus 1 to plus or minus 15 degrees. Pointing accuracy, as well as readout accuracy, of 0.1 degree was implemented. The design accommodates either 115 vac or 28 vdc as the primary power source. A Pb(x)Sn(1-x)Te detector was fabricated. GRA

N76-24564# Hughes Research Labs., Malibu, Calif.
EXCIMER LASERS Semiannual Technical Report, 1 Apr. - 30 Sep. 1975
A. J. Palmer Dec. 1975 65 p refs
(Contract N00014-75-C-0081; ARPA Order 1807)
(AD-A018641; SATR-2) Avail: NTIS CSCL 20/5

The primary goals of this program are to identify specific operating conditions for achieving laser oscillation on the A to X transitions of the diatomic alkali-xenon excimer molecules (excimers) and of the diatomic homonuclear alkali molecule (dimers) and to demonstrate net laser gain in a laboratory experiment from at least one of the alkali-xenon systems. GRA

N76-24565# Ohio State Univ., Columbus. ElectroScience Lab.
LASER ABSORPTION STUDIES Interim Report, 1 Oct. 1974 - 1 Apr. 1975
F. S. Mills, R. K. Long, and E. K. Damon Nov. 1975 40 p refs
(Contract F30602-75-C-0029; ARPA Order 1279)
(AD-A018900; ESL-4054-2; IR-1; RADC-TR-75-289) Avail: NTIS CSCL 07/4

This report covers progress on the various tasks which comprise the subject research program. These tasks include DF laser measurements for HDO and H2O absorbers and CO2 laser absorption measurements on the P(20) and R (20) lines. Additional topics include spectrophone calibration techniques, improvements in calculation programs and design of CO, CO2 and DF probe lasers. GRA

N76-24566+ Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NUMBER 20, APRIL - JUNE 1975
Stuart G. Hibben and Carl Minkus 20 Nov. 1975 115 p refs
(Contract MDA903-76-C-0099; DARPA Order 3097)
(AD-A018639) Avail: NTIS CSCL 20/5

This is the Soviet Laser Bibliography for the second quarter of 1975 and is No. 20 in the series on Soviet laser developments. The coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; crystal growing; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; computer technology; holography; laser-induced chemical reactions; instrumentation and measurements; beam-target interaction; and plasma generation and diagnostics. GRA

N76-24567# California Univ., Berkeley. Electronics Research Lab.
INFRARED SATURABLE ABSORBER DEVICES Final Report, 16 Jun. 1973 - 31 Aug. 1975
S. E. Schwarz Oct. 1975 6 p refs
(Contract DAHC04-73-C-0026)

(AD-A018648; ARO-8733.12-P) Avail: NTIS CSCL 20/5

Gaseous saturable absorbers are studied. These absorbers are used for mode-locking of infrared lasers, particularly CO2. Nonlinear-optical coefficients and transition moments were measured. Detectors for infrared radiation were also studied. Mechanisms of point-contact detectors were determined and antenna patterns of infrared antennas measured. Potentialities of novel antenna-coupled IR detectors were explored. GRA

N76-24568# Avco Corp., Wilmington, Mass.

THE INTERACTION OF LASER RADIATION WITH SMALL PARTICLES Final Report, 1 Nov. 1974 - 30 Jun. 1975

J. M. Yos Hanscom AFB, Mass. AFCRL 31 Aug. 1975 29 p refs

(Contract F19628-75-C-0076; AF Proj. 2153)

(AD-A018659; AFCRL-TR-75-0475) Avail: NTIS CSCL 20/5

This report presents a preliminary theoretical study on the use of an aerosol cloud to attenuate laser radiation. Topics covered in the study include the absorption of laser energy by the aerosol particles, dielectric properties of the aerosol material, and vaporization and breakdown thresholds for the aerosol. The principal conclusion of the study is that small, dipole-resonant aerosol particles offer a promising technique for the efficient attenuation of laser radiation at all flux levels. Author (GRA)

N76-24569# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

EFFECTS OF CO2 LASER ON WATER HYACINTH GROWTH Final Report

Katherine S. Long and Perry A. Smith Nov. 1975 156 p ref

(AD-A018866; WES-APCP-TR-11) Avail: NTIS CSCL 06/6

As a result of earlier experiments indicating the possibility of controlling water hyacinths with laser irradiation, a prototype CO2 laser system (10.6-micrometer wavelength) was designed, fabricated, and adapted for use in an outdoor environment. In the fall of 1972, the laser system was tested and evaluated near Bayou Gauche, Louisiana. Deficiencies were discovered in the test of the prototype. A scanning, flat-mirror system was substituted for the spherical-mirror system. A chiller system was installed to dissipate the excessive heat. Finally, the effects of the salt-air environment were eliminated when the system was moved to Lake Concordia, Louisiana, a freshwater inland lake, where in 1973 and 1974 controlled irradiation ranging from 0.2 to 100 J/sq cm was applied to plots of water hyacinth plants collected in the lake. Plant biomass, height, number, coverage, and number of flowers were measured periodically. Results of the analyses show that laser irradiation causes a significant decrease in growth rates with an increase in irradiation level, but this effect decreases as time passes until there is no significant difference between treated and control plots. Rates of photosynthesis were not significantly affected by laser irradiation. GRA

N76-24570# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THERMAL COEFFICIENT OF REFRACTIVE INDEX OF POLYCRYSTALLINE ZnSe, BaF2 AND CaF2 IN THE VISIBLE AND NEAR INFRARED M.S. Thesis

Hiroaki Mukai Sep. 1975 93 p refs

(AD-A019526; GEO/PH-75-2) Avail: NTIS CSCL 20/6

An interferometric technique has been used to measure the thermal coefficient of the refractive index of polycrystalline ZnSe, BaF2, and CaF2 at the HeNe laser wavelengths, 0.6328, 1.15, and 3.39 micrometers, in the range 25 -65C. The values obtained were calculated using the observed change in optical path and the literature values for refractive index and thermal expansion coefficient. GRA

N76-24571# Avco-Everett Research Lab., Everett, Mass.

LOW PRESSURE LOSS CAVITY FOR REPETITIVELY PULSED ELECTRIC DISCHARGE LASERS Final Report

R. M. Feinberg, R. S. Lowder, and O. L. Zappa Oct. 1975 129 p refs

(Contract F29601-73-C-0116; AF Proj. 3170)

(AD-A018770; AFWL-TR-75-99) Avail: NTIS CSCL 20/5

A low pressure loss cavity is shown experimentally and theoretically to be a viable concept for repetitively pulsed electric discharge lasers. Proper treatment of the acoustic waves traveling upstream as well as downstream has led to high gas mass utilization and high pulse repetition rates. The concept proven on the Humdinger Jr. device having an optical cavity of 4 cm by 100 cm is shown to be scalable to larger optical cavity volumes. Author (GRA)

N76-24572# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

LASER-INDUCED DAMAGE AS A FUNCTION OF DIELECTRIC PROPERTIES AT 1.06 MICROMETERS Final Report, 1973 - 1975

Jerry Ray Bettis 12 Dec. 1975 131 p refs

(AF Proj. 8809)

(AD-A019332) Avail: NTIS CSCL 20/5

Ten dielectric materials in half-wave optically thick films, and eleven uncoated dielectric surfaces were subjected to damaging radiation from (TEM sub 00)Nd(3+) in a glass laser operating at 1.06 micrometers. The threshold optical electric field for damage was determined for each thin film and uncoated surface. It was demonstrated that the root mean square surface roughness was important for determining the threshold field. The basic relationship held for both the bare surfaces and for the thin films placed on surfaces with varying roughness. A theoretic-empirical formula was developed which is used to predict threshold fields as a function of material properties, such as refractive index and atomic number density, and surface roughness as well as thin-film material. The relationship holds for a variety of materials in bulk form as well as bare surfaces and thin-film coatings. Agreement between prediction and experiment was generally within twenty percent, the typical experimental accuracy. A new model of laser-induced damage was developed which accounts for material-to-material variation as well as the dependence of the damage threshold on pulse duration and spot size. GRA

N76-24573# California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.

COMBUSTION DYNAMIC PROCESSES ASSOCIATED WITH ADVANCED LASING SYSTEM. 1: KINETICS AND STRUCTURE OF THE CS2/O2 FLAME LASER Interim Scientific Report, 1 Apr. 1974 - 31 Mar. 1975

F. C. Culick and A. A. Vetter Oct. 1975 120 p refs

(Grant AF-AFOSR-2694-74; AF Proj. 9711)

(AD-A019535; AFOSR-75-1678TR) Avail: NTIS CSCL 20/5

This report is a study of the interactions of chemical kinetics, relaxation processes, and low-speed fluid mechanics for the deflagration of gaseous carbon disulfide and oxygen under conditions for which laser action has been demonstrated. A four-reaction branching chain reaction mechanism is deduced from experimental evidence and reaction rates to represent the chemical kinetics of CS2/O2 combustion. This chain mechanism is used to explain some explosion phenomena and to obtain the initial conditions and initial chemical kinetics expected for the different types of CS2/O2 chemical lasers. The dynamics of chemical population and relaxation, including selective depopulation, of the vibrational levels of CO are discussed. Three analytical methods are employed to solve the premixed laminar flame problem for the CS2/O2 flame. Details are given for the multi-slit injector whose design allows complete control over mixing. Results for this burner and premixed configuration burners are discussed. CO emission spectra were taken from CS2/O2 flames and the relative vibrational populations determined. GRA

N76-24574# TRW Systems, Redondo Beach, Calif.

ADVANCED REACTANTS LASER PERFORMANCE EVALUATION Final Report, 5 Mar. - 31 Aug. 1975

R. A. Ackerman 18 Dec. 1975 93 p refs

(Contract N60921-75-C-0175)

(AD-A018627; TRW-28312-6004-RU-00) Avail: NTIS CSCL 20/5

The objective of this work was to provide preliminary laser performance evaluations for several liquid storable, advanced chemical laser reactant systems. Four advanced reactant systems, F2/MAPPGAS/He, F2/C6F6/He, F2/C7H8/He and F2/C7H8/N2 plus one baseline system F2/C2H2/He were evaluated. Lasing powers between 5 and 8 kw were obtained for all helium diluent systems tested. Significantly lower performance (-3 kw) was obtained with nitrogen diluent. It was concluded that all of the

reactant systems tested in this program would provide acceptable performance for combustion driven DF chemical lasers. It was recommended that nitrogen diluent not be used for high pressure nozzles except in cases where helium diluent was unacceptable.
GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-24575* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VACUUM PRESSURE MOLDING TECHNIQUE Patent
Marvin B. Dow, Harold G. Bush, William M. Haraway, Jr., and John F. Crumpler, inventors (to NASA) Issued 11 May 1976 23 p Filed 24 Jan. 1974 Supersedes N74-23449 (12 - 14, p 1727)
(NASA-Case-LAR-10073-1; US-Patent-3,956,050; US-Patent-Appl-SN-436317; US-Patent-Class-156-242; US-Patent-Class-156-286; US-Patent-Class-264-102; US-Patent-Class-264-267; US-Patent-Class-428-117) Avail: US Patent Office CSCL 13H

A method for molding a silicone elastomer into a fiberglass honeycomb panel previously bonded to a face sheet panel is described. The elastomer is introduced into a mold under vacuum to prevent air entrapment, and the bonded honeycomb panel is positioned above the elastomer filled mold and forced into the elastomer for vacuum filling the honeycomb structure.
Official Gazette of the U.S. Patent Office

N76-24576 British Library Lending Div., Boston Spa (England).
FRICTION AND WEAR OF BALL BEARINGS IN LIQUID SODIUM. PART 1: COMPARATIVE TESTS FOR MATERIALS SELECTION
K. Kleefeldt and G. Gering Jul. 1975 66 p refs Transl. into ENGLISH from journal report KFK 2157 (West Germany), Jul. 1975
(BLL-Risley-TR-2958-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Sodium experiments are described of ball bearings, fabricated out of five different materials, i.e. tool steel (s-6-5-2), stainless high speed steel (BG 42), stellite, ferro-titanite (WF 13.5) and tungsten carbide/cobalt cermet (GT 10/20). With each material, four cageless bearings of the 6207 type were tested under the following test conditions to determine the most promising material for further investigation: test temperature 400 C, axial load 300 kp, speed 200/min, total revolutions, and oxygen concentration less than 10 to 20 ppm. The following results with respect to friction behavior, weight loss, macroscopic and microscopic changes of the races were obtained: The friction torque is very similar for all five materials. The average weight loss for one bearing amounts to 100 to 670 mg for the steel and stellite alloys, 19 mg for ferro-titanite and 2 mg for tungsten carbide. The approximate values for bearing life under these test conditions are for steel and stellite 0.1, for ferro-titanite 0.2 and for tungsten carbide very much greater than 0.2. Author

N76-24577 British Library Lending Div., Boston Spa (England).
VACUUM, BALANCING AND OVERSPEED TESTING PLANT FLOW TURBINE ROTORS
W. Werner [1975] 16 p Transl. into ENGLISH from BWK (West Ger.), vol. 27, no. 6, Jun. 1975 p 258-262
(BLL-CE-Trans-6866-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The author describes the construction of a vacuum, balancing and overspeed testing installation, and indicates the problems that had to be solved in respect of the drive, auxiliary services and auxiliary equipment. Specifically, descriptions are presented of the balancing and overspeeding of turbine rotors, the design of the installation (bunker, main drive, switchgear and distribution facilities), the auxiliary services (vacuum plant, lubrication arrangements, barring arrangement, air cooling, door drivers), and the provisions in respect of safety. Author

N76-24578 National Lending Library for Science and Technology, Boston Spa (England).
THEORY OF HYDRODYNAMIC PRESSURE WORKING FRICTION FOR THE CASE OF A VISCOUS COMPRESSIBLE LUBRICANT
V. L. Kolmogorov, D. G. Gasilova, and I. S. Degtyarev [1975] 15 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 10, 1975 p 65-71 In ENGLISH and RUSSIAN
(NLL-M-25320-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A method is suggested for solving the problem of friction in a viscous compressible lubricant during metal pressure working processes (drawing, hydrodynamic extrusion, rolling, etc.) carried out in a hydrodynamic friction condition. The method of calculation is based on quasilinearisation of non-linear Bellman differential equations using a computer. The problem posed is solved numerically. Graphs of the changes in the pressures and speeds of the lubricant layer given by various kinematic and geometric process conditions are plotted from the calculations. The pressures obtained are compared with the same characteristics as calculated for the case of the flow of an incompressible lubricant. The lubricant layer pressure distribution calculated by the procedure suggested differs greatly from the pressure field obtained using the lubricating material incompressibility condition. Author

N76-24579 British Library Lending Div., Boston Spa (England).
CUTTING OILS FOR FINISHING AND HONING APPLICATIONS
W. Keyser Apr. 1976 19 p Transl. into ENGLISH from Schmiertechnik Tribologie (West Germany), v. 20, no. 1, 1973 p 9-15
(BLL-RTS-10178) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 7 BLL overseas or 21 UK BLL photocopy coupons

Honing and finishing are being increasingly used as fine-machining techniques. It is shown that during these processes, hydrodynamic factors - and thereby the viscosity of the honing oil - play a major role. The influence of honing time on viscosity, cutting speed, and contact pressure is discussed on the basis of experimental results. If high performance is to be achieved, oils must be activated by additives. The functions of honing oils and requirements to be met by them are described with reference to practical experience. Author

N76-24580 British Library Lending Div., Boston Spa (England).
INFLUENCE OF THE TOOL PROPERTIES ON THE FINAL OUTCOME IN SUPER-FINISH HONING
R. Derenthal Apr. 1976 10 p refs Transl. into ENGLISH from Ind.-Anz. (West Germany), v. 89, no. 84, 1967 p 24-26
(BLL-RTS-10177) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 7 BLL overseas or 21 UK BLL photocopy coupons

The hardness of the honing stone decisively influence the outcome of the operation. The research shows that the Rockwell hardness of the honing stone permits only provisory comparisons with stone wear, surface improvement and material removal. A method enabling satisfactory comparisons to be made with stone wear was developed. Author

N76-24581 British Library Lending Div., Boston Spa (England).
DEVELOPMENT OF A NEW HONING TOOL
H. Victor and T. Toenshoff Apr. 1976 9 p Transl. into ENGLISH from CIRP, Ann. Int. Inst. Prod. Eng. Res. (West Germany), v. 18, no. 4, 1970 p 573-576
(BLL-RTS-10176) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 7 BLL overseas or 21 UK BLL photocopy coupons

A newly developed honing tool used with a rigidly fixed workpiece is described. The force for the up and down stroke is applied through a separate spherical surface for each direction of movement. Both form a ball joint with its center on the tool axis in the center of the honing stones. The lower spherical surface transmits the force for the downstroke of the tool, the upper surface for the upstroke. Thus the spherical surfaces are arranged so that the tool is pulled through the work in both

directions. In this way the tool is self centering and it cannot be tilted by outside influences. Author

N76-24582 British Library Lending Div., Boston Spa (England).
IMPROVEMENT IN CIRCULARITY DURING LONG-STROKING HONING
H. Victor and T. Toenshoff Apr. 1976 21 p refs Transl. into ENGLISH from Werkstattstechnik (West Germany), v. 63, no. 1, 1973 p 25-30
(BLL-RTS-10175) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 7 BLL overseas or 21 UK BLL photocopy coupons

A linear increase in pressure through honing stones is favorable for reduction in circularity errors. The number of honing stones and the angles at which they are arranged affect improvements in the shape of non-circular bores. Author

N76-24583 British Library Lending Div., Boston Spa (England).
A REVIEW OF DIFFERENT RESEARCH AND EXPERIMENTAL PROJECTS CONCERNING HONING
R. Rosenberger Apr. 1976 25 p refs Transl. into ENGLISH from Werkstattstecmnik (West Germany), v. 52, no. 2, 1967 p 55-62
(BLL-RTS-10174) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 13 BLL overseas or 39 UK BLL photocopy coupons

The decisive characteristics of honing in practice, i.e. the removal of material, wear of the honing stone and the surface finish, are the focal point of this review of a range of investigations. The individual factors, conclusions and recommendations which make for economical honing, are related to these key points. Author

N76-24584 British Library Lending Div., Boston Spa (England).
TILTING PAD JOURNAL BEARING UNDER STEADY LOAD CONDITIONS
H. H. Ott [1975] 39 p refs Transl. into ENGLISH from VDI Forsh. Ing. Wes. (West Ger.), vol. 40, no. 5, 1974 p 133-144
(BLL-CE-Trans-6834-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

A general calculation procedure for multi-tilting pad journal bearings is described assuming constant oil viscosity and non-elastic and thermally non-deformable pads. The calculation is based on the known results for circular pads with finite width. The calculation procedure for the tilting pad journal bearing produce the resulting Gumbel-curve, the coefficient of friction and the oil throughout. The application of the theory is explained with the example of the journal bearing with three pads. The position of the shaft, the friction loss and the oil throughout are calculated for a given journal bearing and are plotted in a diagram. Author

N76-24585+ Wetenschappelijk en Technisch Documentatie- en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands).
SHIP PROPELLERS: A BIBLIOGRAPHY, 1969 - 1974
Jan. 1975 149 p refs Partly in ENGLISH; GERMAN; FRENCH and DUTCH
(TDCK-65992) Avail: NTIS HC $6.00

Included are 307 abstracts of articles in various languages from 1969 to 1974 covering the following fields: ship propellers in general; propeller design; variable pitch propellers; contra-rotating propellers; nozzle (ducted) propellers; Voith-Schneider propellers; waterjet; bow thrusters; propeller strength and vibration; propeller materials and cavitation. ESA

N76-24586# Division of Mechanical Engineering, Ottawa (Ontario).
A HYBRID COMPUTER MODEL FOR A ROTATING STATOR COMPRESSOR TEST RIG
D. A. J. Millar (Carleton Univ., Ottawa), A. A. Swiderski, and M. S. Chappell Mar. 1974 66 p refs
(ME-241) Avail: NTIS HC $4.50

A hybird computer simulation of a rotating stator compressor test rig is developed and described. The simulation is used to investigate the operation and performance of the compressor and to predict the effects of changes in major control variables such as the air flow throttle, the turbine pressure ratio and the dynamometer load, over the whole of the operating range, including the surge regime. Author

N76-24587*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RELATIVE STIFFNESS OF FLAT CONDUCTOR CABLES
James D. Hankins May 1976 26 p
(NASA-TM-X-73304) Avail: NTIS HC $4.00 CSCL 13M

The measurement of the bending moment required to obtain a given deflection in short lengths of flat conductor cable (FCC) is presented in this report. Experimental data were taken on 10 different samples of FCC and normalized to express all bending moments (relative stiffness factor) in terms of a cable 5.1 cm (2.0 in.) in width. Data are presented in tabular and graphical form for the covenience of designers who may be interested in finding torques exerted on critical components by short lengths of FCC. Author

N76-24588*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS AND DESIGN OF A CANTILEVER-MOUNTED RESILIENT-PAD GAS-LUBRICATED THRUST BEARING
Izhak Etsion Washington May 1976 22 p refs
(NASA-TN-D-8221; E-8667) Avail: NTIS HC $3.50 CSCL 13I

A thrust bearing consisting of pads mounted on resilient, metallic, cantilever beams is described and analyzed. Compliance and stiffness of the bearing assembly are discussed, and the effects of bearing design parameters on performance are shown. After the general analysis, a design example is presented for a flat sector-shaped gas bearing. A special case where zero axial movement of the runner can be obtained is pointed out. Author

N76-24589# Bendix Corp., Kansas City, Mo.
PRESS-FIT INTERFERENCE-LIMIT STUDY FOR MINIATURE ASSEMBLIES
C. W. Elder, Jr. Oct. 1975 50 p refs
(Contract AT(29-1)-613)
(BDX-613-1319) Avail: NTIS HC $4.00

A study was made to determine the effect of press-fit variables on the axial movement of 0.020- and 0.060-in.-dia pins installed in mating collars. Interference limits, the use of lubrication, press-rate, outer diameter of collar, and length of engagement were evaluated. Statistical analysis indicates that the smaller pins were affected more by hole size and surface finish than the larger pins. Lubrication and press-rate had no significant effect upon press-in force or holding-power. A need for improvement in hole measuring techniques is indicated. Other pin-retention methods are recommended when pin dia are less than 0.060 in. Author (ERA)

N76-24590# Bendix Corp., Kansas City, Mo.
HAND DEBURRING OF PRECISION MINIATURE PARTS
L. K. Gillespie Nov. 1975 33 p refs
(Contract AT(29-1)-613)
(BDX-613-1443) Avail: NTIS HC $4.00

Small precision mechanisms, such as timers, switches, and actuators, must have burr-free, sharp-edged parts to operate well. By controlling the size of burrs produced in milling operations, burr removal costs can be lowered, and the repeatability of the edges can be improved. Slower feedrates generally resulted in thinner burrs. The eight different burrs, produced by a side-milling cutter in a single cut, all respond differently to changes in cutting conditions. Cutters having a nonzero helix angle produce longer and thicker burrs than those with a zero helix angle. Radial depth of cut did not influence burr size. Full radius keyseat style cutters with Master Cut tooth geometry produced longer and thicker burrs than similar cutters with square tooth corners. Burrs in 17-4 PH stainless steel were much smaller than those in 303 Se stainless steel. A basic explanation of the formation of milling burrs is presented. Author (ERA)

N76-24591# Sandia Labs., Albuquerque, N.Mex.
MOTION OF A LOOSELY FITTING PISTON IN A CLOSED END CYLINDER CONTAINING A PERFECT GAS
G. W. Stone, G. E. Reis, and P. C. Kaestner Nov. 1975 45 p refs
(Contract AT(29-1)-789)

(SAND-75-0416) Avail: NTIS HC $5.00

The equations of motion are derived for a piston in a closed end cylinder containing a compressible perfect gas. These equations include the possibility of an arbitrary motion imposed on the cylinder. In the analysis, it is assumed that there is a clearance between the piston and the cylinder which is sufficiently small so that the flow in the gap is controlled by viscous forces. Computer code OOPS was written which solves the derived equations of motion. Several cases are examined using the OOPS code. Author (ERA)

N76-24592# Oak Ridge Y-12 Plant, Tenn.

INFLUENCE OF PRESSURE VARIATION ON THE PENETRATION OF ELECTRON BEAM WELDS

G. W. Brandon 16 Jun. 1975 19 p refs Presented at the SME/ERDA Welding and Joining Workshop, Chicago

(Contract W-7405-eng-26)

(Y-OA-1545; Conf-751012-1) Avail: NTIS HC $4.00

Pressure variations typically encountered during vacuum electron beam welding can influence the focus of the electron beam, resulting in significant variations in weld depth and width. This influence is especially noticeable in low-energy, partial-penetration welds. The pressure-focus interaction is discussed and samples of pressure-affected welds are described. Author (ERA)

N76-24593# Heinrich-Hertz-Institute fuer Schwingungsforschung, Berlin (West Germany). Abteilung Mechanik.

CONTRIBUTION OF THE KINETIC BEHAVIOR OF SHAFTS SUPPORTED BY ANISOTROPIC BEARINGS, TAKING INTO ACCOUNT THE GYROSCOPIC ACTION OF THE ROTOR MASS Ph.D. Thesis - Tech. Univ. Berlin [BEITRAG ZUM KINETISCHEN VERHALTEN VON ANISOTROP GELAGERTEN WELLEN UNTER BERUECKSICHTIGUNG DER KREISELWIRKUNG DER ROTORMASSE]

Helmut Hupfer 1974 167 p refs In GERMAN

(TB-176) Avail: NTIS HC $6.75

The influence of a gyroscopic effect on a rotational symmetric shaft with anisotropic bearings was investigated. The gyroscopic moment of a random rotor mass attached to the shaft was derived, based on the works of E.J. Routh, R. Grammel, and G. Hamel. The equations of motion of the undamped system were drawn up, using the bending theory of I. Szabo'. Next, external damping of the rotor was considered and the increase in resonance was predicted. Theoretical results were compared with measurements on a test stand. ESA

N76-24594# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.

EFFECTS OF STRESS RELIEF HEAT TREATMENT ON THE TOUGHNESS OF WELDED JOINTS OF SOME HIGH QUALITY PRESSURE VESSEL STEELS

William Provost Jan. 1976 52 p refs Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.

(MT-112) Avail: NTIS HC $4.50

Recent research work indicates that the post weld heat treatments recommended by the codes of practice for pressure vessels can have an unfavourable effect on the properties of welded joints. In the present investigation, an attempt was made to determine the influence of a stress relief heat treatment on the toughness of welded joints in some high quality pressure vessel steels, during as well as after this heat treatment. For the C-Mn-steel, an important improvement of toughness of the tenso-thermal embrittled zone and in the H.A.Z could be observed after stress relieving. The Nb-micro-alloy steel showed also an important improvement of the H.A.Z. toughness. The large scale tests revealed a rather disappointing overall behavior of the welded joints in the 1 % Cr - 0.5 % Mo steel and in the two quenched and tempered steels, as well in stress relieved as in welded condition. The simulation data indicate that only these two quenched and tempered steels are highly susceptible to reheat cracking. Author (ESA)

N76-24595# Marconi Space and Defence Systems Ltd., Camberley (England).

THE LUBRICATION OF BEARINGS AND SLIP RINGS IN VACUUM Progress Report, 1973

P. J. ODonnell Paris ESA Dec. 1975 36 p

(Contract ESTEC-1852/72)

(ESA-CR-475; T(F)S/072) Avail: NTIS HC $4.00

Bearing tests in vacuum reported earlier have continued to show good performance with the exception of a failure on one grease lubricated bearing rig. 100 rpm, lead film lubricated, bearings have lives ranging from 24,000 to 29,000 hours whilst grease lubricated bearings have been operating for 14,000 to 26,000 hours without significant change in performance. Lead lubricated bearings operating at 1/90 rpm and having lives ranging from 20,000 to 27,000 hours, also show consistent behavior. A slip ring rig designed to test both power and signal level contacts was running in vacuum for 12,000 hours. Apart from the noise performance data gained from this test, wear information, important for predicting brush lives was also obtained. Author (ESA)

N76-24596# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

PREQUALIFICATION TESTS OF HEAT RESISTING LUBRICANTS

Francis Reynaud 1975 32 p refs In FRENCH; ENGLISH summary Sponsored by Direc. de Rech. de Moyens d'Essais Report will also be announced as translation

(ONERA-NT-1975-12) Avail: NTIS HC $4.00

A number of probatory tests are proposed in order to estimate the potentialities of heat-resisting lubricants. The prequalification, limited to the most constraining requirements, is based on the following assumptions: the lubricant is to be used in a mixed system with a 'recirculating lubricant' sector (least exposed shaft bearings, driving pinions for secondary parts) and a 'lost lubricant' sector (supply of the rear bearing, the most exposed). The temperatures are of the order of; recirculating lubricant sector - tank 260-300 C, bearings and hot zones 300-350 C; lost lubricant sector - supply pipes 400 C, bearings 450-500 C. Author (ESA)

N76-24597# Foster-Miller Associates, Inc., Waltham, Mass.

MECHANICAL DUNNAGE SYSTEM KIT FOR COMMERCIAL CONTAINERS Final Report

24 Jul. 1975 180 p

(Contract DAAK02-74-C-0285)

(AD-A019175; CE-7439) Avail: NTIS CSCL 13/4

The objective of this program is the design of a dunnage kit for rapid loading and securing of munitions cargo in commercial shipping containers. The kit includes a pallet on which cargo is pre-staged. A range of concepts were considered. Conceptual design led to selection of a pallet supported on air casters for mobility and secured to the container floor with hot melt adhesive pads. The pads include electric heaters to melt the adhesive for securing after loading and for release when unloading. A dunnage kit using these concepts was designed and a fabrication drawing package prepared. The hot melt concept for pallet restraint was tested with a scaled down mockup pallet and test results confirmed the feasibility of the concept. GRA

N76-24598# Battelle Columbus Labs., Ohio.

INTERFERENCE-FIT-FASTENER INVESTIGATION Final Report, 26 Mar. 1973 - 30 Jun. 1974

Stephen C. Ford, B. N. Leis, D. A. Utah, W. Griffith, S. G. Sampath, and P. N. Mincer Sep. 1975 84 p refs

(Contract F33615-73-C-3121; AF Proj. 1467)

(AD-A018804; AFFDL-TR-75-93) Avail: NTIS CSCL 13/5

The report presents analytical and experimental techniques for defining the stress-strain and deformation states around holes filled with tapered shank interference fit fasteners. A prescription for fatigue-life analysis and prediction is developed wherein the above noted data are used. Stresses and plastic strains around fastener holes are determined analytically for two- and three-dimensional elastic and elastic-plastic cases using AXISOL and MARC computer codes. These results are evaluated based on data obtained from the dislocation etching technique, speckle photography experiments, and electrical resistance strain gages. A fatigue analysis technique is developed based on (1) a mechanics analysis to estimate local stress and strain and (2) a calculation of fatigue damage. This analysis provides a good estimate of life to crack initiation. Fastener installation variables are studied and critical ones selected. Constant amplitude and spectrum

loading fatigue tests are reported and the data used to verify fatigue life predictions. GRA

N76-24599# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
MACHINE CASTING OF FERROUS ALLOYS Interim Report
M. C. Flemings, R. Mehrabian, J. R. Melcher, R. G. Riek, and K. P. Young Oct. 1975 136 p refs
(Contract DAAG46-73-C-0110; ARPA Order 2267)
(AD-A018679; AMMRC-CTR-75-22; IR-3) Avail: NTIS CSCL 13/8

This report covers the research for the period of the eighteenth to the thirtieth month of a four-year program. During tis period the 'Continuous Rheocaster' has been greatly improved and a machine casting system using semi-solid alloys 'Thixocasting' has been developed and operated on pilot basis using a copper base alloy. Work has also continued on low temperature 'model' systems, and on other supporting studies. The high temperature 'Continuous Rheocaster' described earlier has undergone extensive modification and development. It has been used to continuously produce a number of ferrous alloy slurries and a cobalt base superalloy slurry. The apparatus has now been optimized for continuous production of larger quantities of 'Rheocast' ingots, and several hundred pounds have been produced of the 'model' bronze alloy employed previously (905 alloy 88wt%Cu, 10wt%Cu, 10wt%Sn, 2wt%Zn). Internal die temperature measurements were made during the casting of both liquid and semi-solid bronze alloy 905. The low temperature 'Continuous Rheocaster' has been used with the model Sn-Pb alloys employed previously to examine the effects on the slurry structure of cooling rate, shear rate, composition and volume fraction solid. The feasibility of a modified 'Thixocasting' process termed 'Clap Casting' has been demonstrated. GRA

N76-24600# Shaker Research Corp., Ballston Lake, N.Y.
AN EXPLORATORY LABORATORY SIMULATION OF STICK-SLIP INDUCED VIBRATION OF WATER-LUBRICATED COMPLIANT-LAYER BEARINGS
R. L. Smith and C. H. T. Pan Oct. 1975 43 p refs
(Contract N00014-74-C-0278)
(AD-A018998; SRC-75-TR-11) Avail: NTIS CSCL 13/9

An experimental investigation was undertaken to examine the mechanism of sound and vibration generation of a water-lubricated compliant surface bearing system when fluid film separation of the sliding surface is not fully realized. The test bearing is a square pad which was sectioned from a commercially made stern-tube bearing stave. A Lexan disk attached to a drill press spindle provides the sliding surface and permits direct observation of the contact zone. Mounting compliance was varied by using two different methods of attachment of the bearing pad. Low-speed conditions were emphasized (up to 45 psi) with varying load up to 200 psi. Accelerometer and microphone records were obtained at the onset and during self-excited system oscillations. Photographs of the contact zone were taken with and without the presence of vibrations. GRA

N76-24601# Naval Intelligence Support Center, Washington, D.C. Translation Div.
THE EFFECT OF HYDROGEN CONTENT IN AUSTENITE WELDS ON THE TENDENCY TO CLEAVAGE FRACTURE OF LOW-ALLOY STEEL WELDS
I. V. Borovushkin, L. V. Grishchenko, T. V. Kaletina, and G. L. Petrov 26 Nov. 1975 15 p refs Transl. into ENGLISH from Sudostroenie (USSR), no. 12, 1969 p 36-42
(AD-A019223; NISC-Trans-3709) Avail: NTIS CSCL 13/5

As the hydrogen concentration in the metal of austenitic welds increases, particularly at a low austenitic margin, near the boundary of fusion with low and medium-alloy steels, there is formed a zone so depleted of the austenizing elements that it has a noticeable region of martensite structure, as a result of which peel type cracks appear which basically run along the weld metal. At increased hydrogen concentrations, the work of initiation and development of cracks in the weld metal zones near the fusion boundary with the perlite steels decreases, and there is an increase in their tendency to delayed fracture and a decrease of the static fatigue limit. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-24602# Advisory Group for Aerospace Research and Development, Paris (France).
AVIONICS DESIGN FOR RELIABILITY
Mar. 1976 163 p refs
(AGARD-LS-81) Avail: NTIS HC $6.75

Problems of avionics reliability were discussed. Typical methods for forcing reliability into new design and development and into new procurement requirements were described, including a discussion of the relationship between life cycle costs as affected by the reliability achieved. The case for improving initial designs with more background experience, greater patience and thoroughness by the designer is viewed as perhaps the soundest and in the long run the most economical means for reliability attainment. Case histories involving both reliability testing and field reliability achievement are described. For individual titles, see N76-24603 through N76-24614.

N76-24603 Bird Engineering-Research Associates, Inc., Vienna, Va.
AVIONICS RELIABILITY CONTROL DURING DEVELOPMENT
George T. Bird and G. Ronald Herd *In* AGARD Avionics Design for Reliability Mar. 1976 11 p refs (For availability see N76-24602 15-38)

A comparison was made between actual reliability growth observed during recent years and the inherent reliability potential for avionics equipment. A method of control is presented integrating prediction procedures currently outlined in MIL-STD-756 and MIL-HDBK-217 with development testing. A nomograph is presented for determining the amount of design support testing which will be required to achieve a desired or specified value of avionics equipment reliability. It is shown how these control procedures are used for specification, design planning, testing, and monitoring high reliability achievement in avionics equipment. Author

N76-24604 Royal Radar Establishment, Malvern (England).
RELIABILITY GROWTH MODELLING FOR AVIONICS
J. E. Green *In* AGARD Avionics Design for Reliability Mar. 1976 12 p refs (For availability see N76-24602 15-38)

The factors which influence the reliability of avionics were reviewed, with emphasis on the development phase. A method for providing progressive estimates of reliability achievement during the development phase was presented. Reference is made to the use of computer programs for these purposes, and for estimating costs. The validity of the Duane Model is considered against practical experience gained during development of military avionics. Explanations are given for observed deviations in the short and long term periods, and the need to make adjustments for different environmental stress conditions is noted. Further verification of a mathematical law for the rate of appearance of types of systematic (pattern) failure is reported. A review of potential avionic reliability was also given in relation to the increased use of microelectronics and the eventual limiting factors were considered. Author

N76-24605 Sumerlin (W. T.), Hazelwood, Mo.
ILLUSORY RELIABILITY GROWTH
W. T. Sumerlin *In* AGARD Avionics Design for Reliability Mar. 1976 4 p refs (For availability see N76-24602 15-38)

The present meaning of reliability growth was identified and contrasted to earlier concepts. Present needs to devise effective means for administering the later phase of avionic development were recognized. It is during this development phase that an abundance of system failures caused by shortcomings of design, workmanship, and parts selection, mark more or less completely the inherent reliability achievable upon development completion. The mathematical uncertainty of prognosticating a valid schedule for elimination of all pattern failures and achievement of required reliability on the basis of early test experience is examined. It is concluded that accepted means must be used for quantitative

MTBF measurement in the absence of pattern failures, and that quantitative values for MTBF produced by typical growth monitoring in the presence of an abundance of pattern failures can be dangerously misleading. Author

N76-24606 Bird Engineering-Research Associates, Inc., Vienna, Va.

EXPERIENCED IN-FLIGHT AVIONICS MALFUNCTIONS

c06

George T. Bird and G. Ronald Herd *In* AGARD Avionics Design for Reliability Mar. 1976 10 p (For availability see N76-24602 15-38)

The status of current avionics reliability in the field has been evaluated by a study of 98 types of avionics equipment used in a variety of aircraft during a six-month period in 1970. The MTBFs were analyzed by aircraft type and by equipment category (i.e., communication, radar, flight controls, computers, etc.) to reveal correlations with functional complexity. About 4,000 in-flight malfunctions from one type of aircraft covering 28 different equipment types were investigated to show failure modes, repair actions, and probable design causes. Author

N76-24607 Service Technique des Telecommunications de l'Air, Paris (France).

FAILURES AFFECTING RELIABILITY OF AVIONIC SYSTEMS

J. A. Garnier *In* AGARD Avionics Design for Reliability Mar. 1976 11 p In FRENCH and ENGLISH (For availability see N76-24602 15-38)

An automatic system of technical information set up within the French Air Force in conjunction with a basic document, the technical action form, was described, and the principle and conditions of application of guaranteed reliability clauses were discussed. The objective of this system is to determine the actual reliability of a system under operational conditions and to detect the failures affecting reliability. This is not only indispensable in improving the reliability of the equipment considered, but also provides information that is essential in developing new generations of equipment. The main results obtained through this system regarding the actual reliability of equipment and the analysis of the failures affecting reliability were also reviewed. Author

N76-24608 General Dynamics/Fort Worth, Tex. Research and Engineering Dept.

IMPACT OF RELIABILITY IMPROVEMENT WARRANTY (RIW) ON AVIONIC RELIABILITY

C. A. Hardy *In* AGARD Avionics Design for Reliability Mar. 1976 12 p refs (For availability see N76-24602 15-38)

Incentives provided by the Air Force to contractors of new systems to design and produce electronic equipment with low failure rates and low repair costs in operational use were described. These incentives, which are included in procurement contracts as reliability improvement warranty (RIW) provisions, obligate the contractor to accomplish repair and replacement of failed equipment at a fixed price during operational use of the equipment by the Air Force. The contractor also quarantees the mean-time-between-failure of the equipment during the warranty period. The RIW provisions are projected to have a significant impact on avionic reliability. Author

N76-24609 Sumerlin (W. T.), Hazelwood, Mo.

HIGH RELIABILITY DESIGN TECHNIQUES

W. T. Sumerlin *In* AGARD Avionics Design for Reliability Mar. 1976 7 p ref (For availability see N76-24602 15-38)

The general situation between the following two extremes in design techniques was considered: (1) commonplace techniques, with the constraints of holding a normal cost ceiling and schedule, to provide higher reliability than would otherwise be expected, and (2) special and unusual techniques, with greatly extended costs and schedule, to produce much higher reliability. The objective under study was to attain a preferred balance between reliability and all competing factors such as performance, cost, schedule, etc. This requires a thorough understanding of the need for the desired reliability and the probability of its attainment under various trades and compromises. It was concluded that adherence to the discussed techniques and their intent will generally lead to the attainment of optimum reliability prior to the need for a quantitatve reliability verification test, and the question of reliability growth during the development program becomes academic. Author

N76-24610 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

DESIGN OF ELECTRONIC CIRCUITS AND COMPONENT SELECTION FOR HIGH RELIABILITY

Walter Schambeck *In* AGARD Avionics Design for Reliability Mar. 1976 14 p refs (For availability see N76-24602 15-38)

Rules were given for the selection of components for high reliability applications. Determining the suitable technology, part derating factors and then the selection or writing of specifications for parts procurement are described. The necessity of precap visual inspection and screening of components as well as incoming inspection by the user for high reliability applications is emphasized. The use of plastic IC's for Hi-REL applications and a new development in this field is discussed. The second part is concerned with the design of reliable circuits. Precautions to be taken against voltage and current overloading and the selection of the proper supply voltage are described. The use of MSI and LSI and synchronous operation is suggested to increase the reliability. Noise immunity and its influence on reliable operation is discussed. Finally redundancy versus screening and the cost of reliability are considered. Author

N76-24611 General Dynamics/Fort Worth, Tex. Research and Engineering Dept.

AVIONIC RELIABILITY AND LIFE-CYCLE-COST PARTNERSHIP

C. A. Hardy *In* AGARD Avionics Design for Reliability Mar. 1976 14 p (For availability see N76-24602 15-38)

The interface between the reliability and life-cycle cost of avionics weapon systems was discussed. The following areas were treated: (1) definition of life-cycle cost, (2) rationale for promoting the life-cycle cost concept, (3) analysis techniques used to evaluate the life-cycle cost, (4) the life-cycle-cost/design to cost requirements that are contained in present contracts, and (5) the interface between reliability and life-cycle cost during proposal, definition, and production phases. Author

N76-24612 Service Technique des Telecommunications de l'Air, Paris (France).

CASE HISTORY OF SOME HIGH RELIABILITY DESIGNS FOR AVIONIC SYSTEMS

J. A. Garnier and D. Reneric *In* AGARD Avionics Design for Reliability Mar. 1976 23 p In FRENCH and ENGLISH (For availability see N76-24602 15-38)

Four methods developed to obtain high reliability with avionics equipment were described and illustrated. These methods deal with the following areas: (1)components: efforts are directed towards the achievement of manufacturing processes leading to high reliability devices, (2) reliability prediction: appropriate calculations are carried out to analyze the stresses to which components are submitted and to improve circuit design, (3) reliability and burn-in tests: their purpose is to reveal early operation defects and systematic failures, as well as to give an estimation of reliability close to the operational value, and (4) reliability clauses: guaranteed reliability or contractual maintenance clauses ensure that the aim in view has been reached. The main results of a study aimed at analyzing the efficiency of these methods were then presented, based on a cost-reliability standpoint, for a particular example. Finally, the essential lessons learned from the application of these methods to known equipment were brought out. Author

N76-24613 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

RELIABILITY TESTING OF ELECTRONIC PARTS

Walter Schambeck *In* AGARD Avionics Design for Reliability Mar. 1976 18 p refs (For availability see N76-24602 15-38)

A survey of the environmental, physical and electrical tests, which are necessary to establish the reliability of electronic parts, is given. Special emphasis is placed on the testing of semiconductors. All the tests are described together with the failure they can detect in parts. Within these three categories of tests, nondestructive and destructive ones are distinguished. Although most popular tests are mentioned, special emphasis is placed on tests not so widely used yet, such as high stress tests,

acoustical particle detection, thermal mapping by means of liquid crystals and the test of input protection circuits of MOS IC's. The need for visual inspection as a means of improving the quality of components is discussed. Product analysis as a means of evaluation of the parts manufacturer's capability is described in detail. Author

N76-24614* National Aeronautics and Space Administration, Washington, D.C.
AVIONICS DESIGN FOR RELIABILITY BIBLIOGRAPHY
In AGARD Avionics Design for Reliability Mar. 1976 12 p (For availability see N76-24602 15-38)

A bibliography with abstracts was presented in support of AGARD lecture series No. 81. The following areas were covered: (1) program management, (2) design for high reliability, (3) selection of components and parts, (4) environment consideration, (5) reliable packaging, (6) life cycle cost, and (7) case histories. Author

N76-24615# Aerojet Nuclear Co., Idaho Falls, Idaho.
REVIEW OF FAULT TREE ANALYSIS WITH EMPHASIS ON LIMITATIONS
J. B. Fussell 1975 18 p refs Presented at the Conf. on Intern. Federation of Autom. Control, Cambridge, Mass.
(CONF-750860-1) Avail: NTIS HC $4.50

An overview, with references for additional detail, is given for the analyst who wishes to apply the fault tree method for system reliability and safety analysis to industrial situations. The applicability of fault tree analysis and the limitations of such analysis are discussed. The various quantitative measures of system safety and reliability are presented. Author (ERA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-24616 British Library Lending Div., Boston Spa (England).
LEVEL AND UNIFORMITY OF MECHANICAL PROPERTIES OF WIRE FOR PRESTRESSED REINFORCED CONCRETE
L. I. Prokhorova [1975] 7 p Transl. into ENGLISH from Stal (USSR), no. 8, 1975 p 730
(BLL-M-25277-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A statistical analysis was made at Orlovsk steel-rolling works of the strength and plastic properties of reinforcing wire with diameters of 3.0 and 5.0 mm to GOST 8480-63. The existing technology ensures the production on this wire of strength values of 180-212 and 160-190 kg.sq mm respectively with a probability of 99.3%. The scatter values for drawn and tempered wire amount to + or - 1% (range 1.5-3 and 2-4%). A regression equation is derived. It is shown that statistical data on the actual scatter of properties utilized for a more rational use of the reinforcing wire in prestressed reinforced concrete. Author

N76-24617 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF THE REGULARITIES OF THE BENDING FATIGUE FAILURE OF CONCRETES
I. M. Grushko and V. D. Altukhov Apr. 1976 9 p refs Transl. into ENGLISH from Beton i Zhelezobeton (USSR), no. 7, 1972 p 35-37
(BLL-RTS-10196) Avail: British Library Lending Div., Boston Spa, Engl.: £5.00; 7 BLL overseas or 21 UK BLL photocopy coupons

Fatigue in concrete mixes was studied by static and cyclic loading. The deformation modulus and the bending coefficients were determined. The stress effects of the cyclic loading on the mechanical properties of concrete are given. F.O.S.

N76-24618 Utah Univ., Salt Lake City.
THE STRESS DISTRIBUTION IN A THICK CRACKED PLATE UNDER AN IN-PLANE SHEAR LOAD Ph.D. Thesis
Si-Tsai Lin 1975 58 p
Avail: Univ. Microfilms Order No. 76-9816
Using an integral formulation method, the three-dimensional elastic stress and displacement fields at the crack front of a thick plate under an in-plane shear load (mode 2) are obtained. It is found that the strength of the singularity under a mode 2 load is exactly the same as that of a mode 1 load. Dissert. Abstr.

N76-24619 New Hampshire Univ., Durham.
STATIONARY AND NONSTATIONARY RANDOM VIBRATIONS OF CABLES, PLATES AND BEAMS WITH AN APPLICATION TO OCEAN STRUCTURES Ph.D. Thesis
Frank Philip Alberti, Jr. 1975 240 p
Avail: Univ. Microfilms Order No. 76-11677

The mean square responses of lightly damped finite viscoelastic cables and simply supported plates and beams to a special type of nonstationary random excitation are determined. The excitation function is taken in the form of a product of a well defined, slowly varying envelope function, and a part which prescribes the statistical characteristics of the excitation. The latter is assumed to be white or correlated as a wide band process. By taking into consideration the slow variation of the envelope function and the wave characteristics of the lightly damped viscoelastic medium, the mean square nonstationary responses (for the various types of excitation and damping parameters) are evaluated for these structural elements. The stationary mean square responses of the structural elements mentioned above are also determined for the case of a correlated moving force field. Dissert. Abstr.

N76-24620*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SRM ATTRITION RATE STUDY OF THE AFT MOTOR CASE SEGMENTS DUE TO WATER IMPACT CAVITY COLLAPSE LOADING
Charles D. Crockett May 1976 50 p refs
(NASA-TM-X-73303) Avail: NTIS HC $4.00 CSCL 21H

The attrition assessment of the aft segments of Solid Rocket Motor due to water impact requires the establishment of a correlation between loading occurrences and structural capability. Each discrete load case, as identified by the water impact velocities and angle, varies longitudinally and radially in magnitude and distribution of the external pressure. The distributions are further required to be shifted forward or aft one-fourth the vehicle diameter to assure minimization of the effect of test instrumentation location for the load determinations. The asymmetrical load distributions result in large geometric nonlinearities in structural response. The critical structural response is progressive buckling of the case. Discrete stiffeners have been added to these aft segments to aid in gaining maximum structural capability for minimum weight addition for resisting these loads. This report presents the development of the attrition assessment of the aft segments and includes the rationale for eliminating all assessable conservatisms from this assessment. Author

N76-24621# Army Engineer Waterways Experiment Station. Vicksburg, Miss.
PAVEMENT RESPONSE TO AIRCRAFT DYNAMIC LOADS. VOLUME 2: PRESENTATION AND ANALYSIS OF DATA. APPENDIX B: DATA Final Report
Richard H. Ledbetter Sep. 1975 589 p
(Contract DOT-FA71WAI-218)
(AD-A018337/6; S-75-11-Vol-2-App-B;
FAA-RD-74-39-Vol-2B) Avail: NTIS HC $13.75 CSCL 13/2

This appendix presents the reduced pavement response data for the aircraft dynamic load tests. Comparisons of static and dynamic load responses are shown. Summarized results are presented in Volume 2 of this report. Volume I describes the testing program and instrumentation systems, and Volume 2 with Appendixes A and B presents the reduction and analysis of data and the test results. Volume 3 contains a compendium of the entire study. Author

N76-24622*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM FOR ANISOTROPIC SHALLOW-SHELL FINITE ELEMENTS USING SYMBOLIC INTEGRATION
C. M. Andersen (Coll. of William and Mary, Williamsburg, Va.)

and John T. Bowen Washington Jun. 1976 127 p refs (NASA-TM-X-3325; L-10483) Avail: NTIS HC $6.00 CSCL 13M

A FORTRAN computer program for anisotropic shallow-shell finite elements with variable curvature is described. A listing of the program is presented together with printed output for a sample case. Computation times and central memory requirements are given for several different elements. The program is based on a stiffness (displacement) finite-element model in which the fundamental unknowns consist of both the displacement and the rotation components of the reference surface of the shell. Two triangular and four quadrilateral elements are implemented in the program. The triangular elements have 6 or 10 nodes, and the quadrilateral elements have 4 or 8 nodes. Two of the quadrilateral elements have internal degrees of freedom associated with displacement modes which vanish along the edges of the elements (bubble modes). The triangular elements and the remaining two quadrilateral elements do not have bubble modes. The output from the program consists of arrays corresponding to the stiffness, the geometric stiffness, the consistent mass, and the consistent load matrices for individual elements. The integrals required for the generation of these arrays are evaluated by using symbolic (or analytic) integration in conjunction with certain group-theoretic techniques. The analytic expressions for the integrals are exact and were developed using the symbolic and algebraic manipulation language. Author

N76-24623# Bettis Atomic Power Lab., West Mifflin, Pa.
DETERMINATION OF STIFFNESS AND LOADING IN BOLTED JOINTS HAVING CIRCULAR GEOMETRY
G. R. Sharp Nov. 1975 51 p refs
(Contract E(36-1)-GEN-14)
(WAPD-TM-1105) Avail: NTIS HC $5.00

A synthesized technique to aid in predicting the overall dynamic or static response of a bolted connection to externally applied dynamic or static tractions is presented. The technique is a synthesis of an existing method for determining stiffness coefficients in a bolted connection together with concepts and analysis techniques presented in this document. The information presented is considered a first step in the development of an analytical technique for predicting the overall stiffness of a bolted connection having circular geometry. Author (ERA)

N76-24624# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE ADMISSIBILITY OF SIMPLIFICATIONS IN THE SIMULATION OF RANDOMLIKE OPERATIONAL LOADS [UEBER DIE ZULAESSIGKEIT VON VEREINFACHUNGEN IN DER SIMULATION ZUFALLSARTIGER BETRIEBSBEANSPRUCHUNGEN]
E. Gassner 10 Mar. 1975 13 p refs In GERMAN
Avail: NTIS HC $3.50

Stress-time functions of a random nature were investigated for simulation of operational loads on structurebound materials to determine fatigue life. The random processes considered have one- or two-peaked power spectral densities. Materials investigated were steels CK 45 and 42 Cr Mo 4. ESA

N76-24625# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
FATIGUE STRENGTH OF STEEL St 52 CRUCIFORM JOINTS WITH DOUBLE BEVEL PREPARATION
E. Haibach and R. Olivier Apr. 1975 44 p refs In GERMAN; ENGLISH summary Sponsored partly by Ver. Deut. Eisenhuettenleute and partly by Komm. der Europaeischen Gemeinschaften
(LBF-FB-120/75) Avail: NTIS HC $4.00

Results are presented from S-N tests on a cruciform type of joint with double bevel preparation welded in special quality (full penetration, grinded toe of the fillets) plate material MRR St 52-3. The fatigue crack almost always started at the toe of the fillets. As small defects in the weld may be undetected by X-ray examination and therefore have to be accepted, the evaluation considers a possible fatigue crack starting within the weld or a crack starting at the toe. A total of 16 variants in specimen fabrication were investigated and evaluated by a multi-dimensional variance analysis: final rolling direction of the plate material parallel or transverse to the loading direction in the test, welding of the specimens in two institutes, welding with rutile (Ti VIIIs) or with basic coated (Kb IXs) electrodes, specimens in the as-welded condition or stress relieved. Author (ESA)

N76-24626# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
FATIGUE BEHAVIOR OF DUCTILE MATERIALS UNDER MULTIAXIAL OUT OF PHASE STRESSES WITH CONSTANT AND CHANGING DIRECTIONS OF PRINCIPAL STRESSES
A. Simbuerger 1975 252 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(LBF-FB-121/75) Avail: NTIS HC $9.00

A new concept that can be applied both for the constant and for the changing directions of principal stresses was developed. The computer programs for calculation are elaborated. The validity of the new concept was proved through an extensive research program. Author (ESA)

N76-24627# Stuttgart Univ. (West Germany). Inst. fuer Statik un Dynamik der Luft- und Raumfahrtkonstruktionen.
INGA. USER'S REFERENCE MANUAL
Ingolf Grieger 1974 181 p refs
(ISD-156) Avail: NTIS HC $7.50

A user manual is presented for the INGA (Interactive Graphic Analysis) interaction program system. This program performs computer-aided structural analysis and computer-aided design. The INGA system is modular and the main part is written in FORTRAN. The facility consists of a Control Data 1700 computer and associated peripheral devices, the most important for interaction being the display console with two main components: a 1744 Digigraphic Controller and a 274 cathode-ray tube with associated light pen. ESA

N76-24628# Naval Construction Research Establishment, Dunfermline (Scotland).
COMPRESSIVE STRENGTH OF WELDED STEEL SHIP GRILLAGES
May 1975 78 p refs
(NCRE/R611; BR48905) Avail: NTIS HC $5.00

Results are presented of a series of tests on full scale welded steel grillages representing typical warship deck and single bottom structures under compressive load combined in some cases with lateral pressure. Experimental results are discussed in relation to currently available analysis methods. Design recommendations are made together with suggestions on the need for further research. Author (ESA)

N76-24629# Florence Univ. (Italy). Dept. of Civil Engineering.
RELIABILITY OF SLENDER COLUMNS: COMPARISON OF DIFFERENT APPROXIMATIONS
Guiliano Augusti and A. Baratta (Naples Univ.) 1974 31 p refs Presented at the IUTAM Symp. on Buckling of Struct., Harvard Univ., 17-21 Jun. 1974 Sponsored by CNR
(UFIST/02/1974) Avail: NTIS HC $4.00

Based on a probability treatment of column buckling problems, numerical results are presented pertaining to the probability of failure, under random axial loads, of imperfection sensitive structures such as an elastoplastic column. Several approximation procedures to reduce the necessary calculations are proposed and discussed. All of these require the determination of the cumulative probability distribution, the column strength and its derivative in the low range of probabilities. ESA

N76-24630# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
REMARKS ON THE ELASTOPLASTIC CALCULATION OF SUPPORTING STRUCTURES [BEMERKUNGEN ZUR ELASTOPLASTISCHEN BERECHNUNG VON TRAGWERKEN]
J. S. Doltsinis and H. A. Balmer 1974 19 p refs In GERMAN
(ISD-169) Avail: NTIS HC $3.50

The elastoplastic behavior of supporting structures is discussed. The incremental stress-strain relationships were derived from Hooke's law and from a derivation of this law. The elastoplastic incremental stress-strain relationships, in which

second order terms in the Taylor series were used, are dealt with. The analytical solution for a plane disk of ideal plastic material is given and remarks on the calculation of the elastoplastic problem using the initial load method are made. ESA

N76-24631# Technische Hochschule, Aachen (West Germany). Lab. fuer Ultraschall.

INVESTIGATION ON THE POSSIBILITIES OF ULTRASONICALLY WELDING METALS THROUGH PLASTIC LAYERS Final Report [UNTERSUCHUNGEN UEBER MOEGLICHKEITEN DES ULTRASCHALLSCHWEISSENS VON METALLEN DURCH KUNSTSTOFFSCHICHTEN HINDURCH]

D. Leven and R. Pohlman 1974 22 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft

Avail: NTIS HC $3.50

Welding without rupturing the plastics, was investigated with special application to stripline connectors of solar cells. Both one sided excited and double sided excited ultrasonic welding techniques were used. The method was shown to be applicable to plastic-metal-metal and plastic-metal-metal-plastic combinations provided plastics with a high plasticity point and excellently weldable metals such as aluminum, silver, and clean copper are used. ESA

N76-24632# Technische Hochschule, Aachen (West Germany). Lab. fuer Ultraschall.

INVESTIGATIONS ON INCREASING ULTRASONIC WELDING POSSIBILITIES USING AN EXTERNALLY EXCITED ANVIL Final Report [UNTERSUCHUNGEN UEBER DIE ERWEITERUNG DER MOEGLICHKEITEN DES ULTRASCHALLSCHWEISSENS DURCH EINEN FREMDERREGTEN AMBOSS]

D. Leven and R. Pohlman 1974 19 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft

Avail: NTIS HC $3.50

The possibility of increasing the aluminum ultrasonic weld strength by double sided excitation was investigated. The technique was shown to increase the energetic effectiveness in the weld material, leading to a decrease of parasitic loss in the weld material. Also, thicker plates can be welded, with less weld damage to the upper plate. On welding blunt bolts with the double sided contraphase excitation technique the weld strength was improved. ESA

N76-24633# Bristol Univ. (England). Dept. of Aeronautical Engineering.

THE STABILITY OF SIMPLY-SUPPORTED SANDWICH PANELS WITH FIBRE REINFORCED FACEPLATES Ph.D. Thesis

Thomas Robert Arthur Pearce Sep. 1973 220 p refs Sponsored by Sci. Res. Council

Avail: NTIS HC $7.75

The research is concerned with the stability under in-plane loading of simply-supported sandwich panels with laminated fibre-reinforced faceplates. Three types of faceplate lay-up are considered and they are referred to as symmetrical, angle-ply and cross-ply. Each one exhibits a particular type of coupling between the various faceplate strains and curvatures. The diffential equations are developed for all three types of faceplate. They are solved to give the overall buckling and faceplate wrinkling loads under uniaxial compression for faceplates for which all the coupling terms are zero. By using reduced bending stiffnesses these results are then applied to give approximate values for angle-ply and cross-ply faceplates. Previous solutions to the buckling of symmetrical thin plates are investigated and an improved solution, using the Rayleigh-Ritz technique is given. This technique is then applied to sandwich panels with symmetrical faceplates to yield the overall buckling loads under compression and shear. Both the plate and sandwich panel solutions are shown to give non-conservative results as the boundary conditions of zero moment are not exactly satisfied. Experimental work reported consists of the manufacture of sandwich panels, tests to determine their elastic properties and their subjection to uniaxial compression. Author (ESA)

N76-24634# Bristol Univ. (England). Dept. of Civil Engineering.

THE DYNAMIC FOUNDATION INTERACTION OF MULTI-STOREY FRAMES

A. Aydin Dumanoglu Jun. 1973 207 p refs Sponsored by Karadeniz Tech. Univ.

Avail: NTIS HC $7.75

The effects of foundation interaction upon the dynamic response of buildings during an earthquake were investigated. To simulate this effect under laboratory conditions three models were constructed in which foundation (ground) and structures were combined. Two of these were combined plane frames with a Young's modulus of foundation, Ef = 45 kg/sq cm and Ef = 405 kg/sq cm respectively. The third was an asymmetric space frame with a Young's modulus of foundation, Ef = 45 kg/sq cm. Elastomers, compounds of Adiprene L-100 or L-167, were used to simulate the foundation medium, and into this the footings of the plane and space frames, all of which had five storeys. were embedded. Analysis was in two stages. In the first stage the resonance behavior of these combined models was analyzed. In the second the dynamic response analysis was made. Author (ESA)

N76-24635# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).

ANALYTICAL STUDIES ON FOLDABLE TUBES Final Report

J. Fernandez-Sintes Mar. 1974 87 p refs

(Contract ESTEC-729/69-AA)

(ESA-CR(P)-793) Avail: NTIS HC $5.00

Theoretical analyses and derived design criteria were developed to take into account the effect of prestressing in foldable tubes for satellite hinges. An analysis is made of the stress distribution which develops in a prestressed tube folded in the stowage configuration. This analysis leads to design criteria relating minimum length and parameter range for elastic design. The flexural behavior of a prestressed tube is analyzed and results in the form of dimensionless parameters are given to determine an estimate of the flexural collapse load. The analyses are applied to INTA TEP foldable prestressed tubes. Author (ESA)

N76-24636# Federal Highway Administration, Washington, D.C. Structures and Applied Mechanics Div.

CORRELATION OF THEORETICAL AND EXPERIMENTAL DATA FOR HIGHWAY BRIDGES. VOLUME 1: STATIC LOADING

Haaren A. Miklofsky Apr. 1974 329 p Prepared in cooperation with Arizona Univ., Tucson

(PB-245812/3; FHWA-RD-75-37-Vol-1) Avail: NTIS HC $10.00 CSCL 13B

A computer programmmed analytical routine SSAP2 is used to correlate a theoretical finite element analysis with experimental responses of four typical two land multispan girder and slab highway bridges in Tennessee. All bridges give excellent correlation between predicted and experimental responses for deflection and moment distribution to the girders, when the stringers are modelled with beam elements slave connected to plate shell elements for the deck. The aspect ratio of element modelling is a critical factor for the finite element analysis. It is concluded that reasonable analytical results can be obtained with the SSAP2 program for non-skew straight composite beam bridges and skew composite beam bridges for low skew angles provided all element aspect ratios are limited to 1.5 or less. GRA

N76-24637# Army Construction Engineering Research Lab., Champaign, Ill.

EVALUATION OF ALTERNATE WIRE FABRIC MATERIALS FOR ARTICULATING CONCRETE MATTRESSES Final Report

Edward Cox, Christopher Hamin, and James Aleszka Nov. 1975 39 p refs

(AD-A018951; CERL-TR-M-169) Avail: NTIS CSCL 13/3

The objective of this study is to evaluate candidate wire fabric materials as alternatives to Copperweld and AISI 301 stainless steel in articulated concrete revetment mattresses. This will increase the number of materials which can perform satisfactorily as wire fabric, increase the number of wire fabric suppliers, and reduce the cost. This report is limited to wire fabric materials used in articulated concrete mats placed in fresh water on the Mississippi River above New Orleans. GRA

N76-24638# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
COMPARISON OF THE PERFORMANCE OF ALL-BITUMINOUS CONCRETE AND REDUCED SUBGRADE STRENGTH HIGHWAY PAVEMENT TEST SECTIONS UNDER FREEZING CONDITIONS
Robert A. Eaton Dec. 1975 40 p refs
(DA Proj. 4K0-780012-AAM-1)
(AD-A019104; CRREL-TR-270) Avail: NTIS CSCL 13/2

Four highway pavement test sections were built at CRREL in July 1971. Two sections were designed using the Asphalt Institute full-depth criteria in which the pavement is placed directly upon the subgrade with no granular base course, and the other two were based on similar traffic volumes using the Corps of Engineers reduced subgrade strength criteria which incorporate a granular base course. The sections were constructed to compare and evaluate the performance of the two different concepts under freeze-thaw conditions. The first three years' observations are reported. GRA

N76-24639# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technologies Div.
STATISTICAL CRITERION FOR HAZARD OF MATERIAL FAILURE IN A COMPLEX STRESSED STATE
D. M. Shur 9 Dec. 1975 18 p refs Transl. into ENGLISH from Mashinovedenie (USSR), no. 1, Jan. - Feb. 1971 p 51-58
(AD-A019167; FTD-ID(RS)I-2419-75) Avail: NTIS CSCL 20/12

In the work a comparatively simple statistical model of a solid is proposed which makes it possible to appraise the danger of failure depending on the type of stressed state. GRA

N76-24640# Naval Civil Engineering Lab., Port Hueneme, Calif.
DEVELOPMENT OF AN ICE EXCAVATION MACHINE Report for Jul. 1973 - Jun. 1975
K. D. Vaudrey Dec. 1975 20 p refs
(YF52555002)
(AD-A018956; CEL-TN-1415) Avail: NTIS CSCL 13/3

A review of operational requirements indicates a continuing need for equipment to excavate ice to facilitate polar construction. A 30-hp ladder-type trencher was selected and purchased for its low ground pressure and versatility. The chain was outfitted with specially designed conical ice teeth, and a rotating ice chipper drum was designed and fabricated for the backhoe arm. Both modifications were tested in a laboratory situation for performance and suitability for field operation. A similar, but larger machine with identical teeth, procured under a separate task, was observed during and extended Antarctic ice-trenching operation. Laboratory tests and field observations showed that the ice excavation machine was easy to operate and provided maintenance free performance during all of its trails. GRA

N76-24641# Rome Air Development Center, Griffiss AFB, N.Y.
EVALUATION OF FOAM CORE PANEL Final Technical Report
John J. Guba Dec. 1975 53 p refs
(AD-A019336; RADC-TR-75-281) Avail: NTIS CSCL 13/3

The report presents the results of deflection testing of one type cargo container panel constructed of high strength US steel cor-ten low alloy steel sheets with a foamed plastic core. A tabulation of plastic structural foams is presented to further the understanding of the potential usage of these materials. Quality control information is also provided for slab foam and pour-in-place foaming processing. GRA

N76-24642# Naval Air Development Center, Warminster, Pa.
BENT PLATE COMPUTER PROGRAM LISTING
Oct. 1975 76 p
(AD-A018999; NADC-75251-20B; DOD/DF-75/003B) Avail: NTIS CSCL 09/5

The program can be used to show the electromagnetic scattering effects from a flat or bent plate. One antenna or an array of antennas can be mounted near the plate. The program will compute information necessary for antenna pattern plots. If the plots are desired, a magnetic tape drive is necessary to run the program. The generated tapes from these programs can be used on a California Computer Products, Inc's CALCOMP pen plotter, model 763, to produce the desired antenna patterns. GRA

N76-24643# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
SINGER: A COMPUTER CODE FOR GENERAL ANALYSIS OF TWO-DIMENSIONAL REINFORCED CONCRETE STRUCTURES. VOLUME 1: SOLUTION PROCESS Final Report, Aug. 1972 - Aug. 1974
S. M. Holzer, R. J. Melosh, R. M. Barker, and A. E. Somers May 1975 209 p refs
(Contract F29601-73-C-0022; AF Proj. 5710; DNA Proj. NWED-QAXSC157)
(AD-A011942; AFWL-TR-74-228-Vol-1) Avail: NTIS CSCL 13/13

The mathematical model and the solution process which form the basis of the computer program SINGER are described. The function of SINGER is to predict the behavior of plane skeletal reinforced concrete structures in their environments. Of primary interest is the transient nonlinear response including element failures and structural collapse. The structure is represented by a discrete model composed of line elements (models of partial joint releases). The line elements admit geometric and physical nonlinearities; they can predict the behavior of reinforced concrete members subject to axial and flexural distortions up to failure. The state of the element is characterized by its internal energy. The state of the system is defined by the work function, a scaler function that contains implicitly all the forces acting on the system. The work function is uniquely defined in terms of the generalized coordinates, which must be related to the equilibrium path (motion) when the system behaves nonlinearly. The solution process (the determination of the generalized coordinates relative to a prescribed load or a specific time) is based on the minimization of the work function. Stable equilibrium states of the system correspond to points at which the work function assumes a relative minimum. Author

N76-24644# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
SINGER: A COMPUTER CODE FOR GENERAL ANALYSIS OF TWO-DIMENSIONAL CONCRETE STRUCTURES: VOLUME 2: PROGRAM DOCUMENT Final Report, Aug. 1972 - Aug. 1974
R. M. Barker, R. J. Melosh, and S. M. Holzer May 1975 461 p refs
(Contract F29601-73-C-0022; DNA Proj. NWED-QAXSC157)
(AD-A012211; AFWL-TR-74-228-Vol-2) Avail: NTIS CSCL 13/13

Program documentation is presented for the SINGER computer code. A general description of analysis flow, writeups and flowcharts of the individual routines, instructions for modifying the program capacity, error messages, and a complete listing of the code are included. When activated the SINGER program predicts the transient response of two-dimensional reinforced concrete frames subjected to time varying loadings including the effects of nonlinear material and large geometry changes. Author

N76-24645# National Bureau of Standards, Washington, D.C.
DURABILITY AND RELATED TESTS FOR SELECTED ELEMENTS AND MATERIALS USED IN THE EXTERIOR ENVELOPE OF BUILDINGS Final Report
Larry W. Masters, Elizabeth J. Clark, Gerald A. Sleater, and Arthur Hockman Nov. 1975 151 p refs
(PB-248685/0; NBSIR-75-955) Avail: NTIS HC $6.75 CSCL 13C

This report contains compendium of state-of-the-art methods to aid in the durability testing of selected elements and materials used in the exterior envelope of buildings. The purposes of the report are to identify currently available property measurement tests and aging tests that can be used for durability testing and to identify the degradation factors included in each aging test. The report will form the basis for selecting specific elements and materials for inclusion in subsequent comprehensive durability studies. These additional studies are needed because existing short-term methods are seldom fully adequate for predicting long-term performance. Gra

N76-24646# Florida Dept. of Transportation, Gainesville. Office of Materials and Research.
RIGID PAVEMENT DESIGN: CONTRACTION JOINT SPACING Final Report
W. B. Stelzenmuller Jul. 1975 34 p Prepared in cooperation with Florida State Dept. of Transportation
(PB-249055/5; RR-190) Avail: NTIS HC $4.00 CSCL 13B

A study was made of the effect on riding quality of variation in contraction joint spacing and skew angle of joints to the centerline on a section of interstate 10 in Santa Rosa County (West Florida). Nine sections, each one half mile in length, were constructed in 1967, and included sections with standard 20-foot spacing, with two types of irregular spacing, with perpendicular transverse joints, and with a skew of approximately 2 feet in 12 feet. The study extended over a period of seven and one half years from completion of construction in June 1967. GRA

N76-24647# California Dept. of Transportation, Sacramento. Transportation Lab.
PORTLAND CEMENT CONCRETE PAVEMENT TEXTURE QUALITY INVESTIGATION Interim Report, 1967 - 1973
B. F. Neal, R. J. Spring, J. H. Woodstrom, and D. L. Spellman Jan. 1975 74 p refs Sponsored by DOT
(PB-248779/1; CA-DOT-TL-3126-10-75-07; FHWA-RD-76-S0433) Avail: NTIS HC $4.50 CSCL 13C

Methods of obtaining more durable skid resistant Portland cement concrete pavement surfaces were investigated. The primary factors studied were curing and texturing methods, and quality of the surface mortar. GRA

N76-24648# California Dept. of Transportation, Sacramento. Transportation Lab.
EVALUATION OF COMPACTION OF CEMENT TREATED BASES Final Report
Brian D. Murray May 1975 26 p refs
(PB-249285/8; CA-DOT-TL-3382-1-75-12; FHWA-RD-76-S0437) Avail: NTIS HC $4.00 CSCL 13C

A persistent small percentage of California's Portland cement concrete (PCC) pavements develop a faulting condition. Generally, California's PCC pavements are constructed over cement treated aggregate bases (CTB), which are suspected of abrading and contributing to faulting. Trimming to grade of the CTB during placement is believed to contribute to a loss in its surface integrity. Twenty-one CTB test sections were studied to evaluate the surface characteristics of both conventionally placed (trimmed) and experimentally placed CTB using a 'no-trim' method. The field investigations indicated that CTB can be placed using a 'no-trim' method and meet the specifications imposed for conventionally placed CTB. GRA

N76-24649# Bureau of Mines, Boulder City, Nev. Metallurgy Research Lab.
STUDIES OF SAND-SULFUR-ASPHALT PAVING MATERIALS Report of Investigations
T. A. Sullivan, W. C. McBee, and K. L. Rasmussen Nov. 1975 25 p refs
(PB-249701/4; BM-RI-8087) Avail: NTIS HC $3.50 CSCL 13C

The use of sulfur combined with either sand or waste copper tailings was investigated as a substitute for good graded aggregate in asphalt paving materials as part of a sulfur utilization program. The development of paving mixtures with fine sands or trailings with sulfur and asphalt was accomplished in the laboratory and tested by laying small test paving sections. Small scale testing showed that these mixtures were suitable paving materials which were placed without compaction. Modifying the sulfur by reaction with dicyclopentadiene before mixing with the sands and asphalt was effective in modifying the sand-sulfur-asphalt mixture so that it could be placed and compacted with conventional paving equipment. GRA

N76-24650# Texas Univ., Austin. Center for Highway Research.
CUMULATIVE DAMAGE OF ASPHALT MATERIALS UNDER REPEATED-LOAD INDIRECT TENSION
Calvin E. Cowher and Thomas W. Kennedy Jan. 1975 234 p refs Sponsored by Tex. State Dept. of Highways and Public Transportation and Federal Highway Admin.
(PB-249358/3; FHR-3-9-72-183-3; FHWA-RD-76-S0438) Avail: NTIS HC $8.00 CSCL 13B

Relationships between fatigue life and stress were established for simple-loading fatigue data from which Miner's hypothesis could be verified for compound-loading fatigue life prediction. The hypothesis was evaluated experimentally by conducting compound-loading fatigue tests in which two stress levels were used. In addition, it was shown that it was possible to predict the permanent deformations which occur under two-level compound loading conditions from the simple summation of damage increments from simple-loading permanent deformation curves. Statistical estimates of the fatigue life of the asphalt mixtures investigated are presented for both the simple-loading and compound-loading test series. GRA

N76-24651# Texas A&M Univ., College Station.
FLEXIBLE PAVEMENT DESIGN AND MANAGEMENT: SYSTEMS APPROACH IMPLEMENTATION Final Report
R. L. Lytton, W. F. McFarland, and D. L. Schafer Dec. 1975 66 p refs Sponsored in part by Am. Assoc. of State Highway and Transportation Officials, Washington, D. C. and Federal Highway Admin., Washington, D. C.
(PB-249301/3; TRB/NCHRP/REP-160; ISBN-0-309-02339-4; LC-75-34977) Avail: NTIS HC $4.50 CSCL 13B

This report describes an operational computer program (SAMP6) that provides a basis for selecting flexible pavement design and management strategies with the lowest predicted total cost over a prescribed analysis period when considering such cost elements as initial construction, routine maintenance, periodic rehabilitation, interest on investment, salvage value, and roadway users cost. The program uses the AASHTO Interim Guides as its structural subsystem and the predicted decrease in serviceability with time and traffic as developed at the AASHO Road Test. The strategy selection capability is a quantitative procedure for considering long-term advantages and disadvantages of staged construction versus strong initial structural designs. GRA

42 GEOSCIENCES (GENERAL)

N76-24652# Los Alamos Scientific Lab., N.Mex.
SOLID EARTH GEOSCIENCES RESEARCH ACTIVITIES AT LASL, 1 JULY - 31 DECEMBER 1974
T. R. McGetchin, comp. Jul. 1975 93 p refs
(Contract W-7405-eng-36)
(LA-5956-PR) Avail: NTIS HC $5.45

The present major efforts in energy related research are the dry hot rock geothermal energy project and the rock melting subterrene, an electrically powered, high temperature experimental drilling technique. Research activities in support of geothermal energy include: (1) geochemical and petrological investigations of drill cores; (2) physical and mechanical properties of the cores, in situ and in the laboratory. (3) seismology, (4) experimental and numerical investigation of the chemical interaction of granite and hot aqueous solutions, and (5) field and laboratory investigations of heat flow and the thermal properties of the cores. ERA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-24653*+ New Mexico Univ., Albuquerque.
REMOTE SENSING OF NATURAL RESOURCES: QUARTERLY LITERATURE REVIEW First Quarter, 1976
[1976] 222 p Sponsored by NASA
(NASA-CR-147151) Copyright. Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 08F

A quarterly review of technical literature concerning remote sensing techniques is presented. The format contains indexed and abstracted materials with emphasis on data gathering techniques performed or obtained remotely from space, aircraft, or ground-based stations. Remote sensor applications including the remote sensing of natural resources are presented. A.S.K.

N76-24654+ AMR/PREUSSAG A.G., Hannover (West Germany).
MANGANESE NODULES: A BIBLIOGRAPHY 1878 - 1975 [BIBLIOGRAPHIE DER MANGANKNOLLEN-LITERATUR 1878-1975]
Rainer M. A. Fellerer Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 123 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-75-03) Avail: NTIS HC $5.50; ZLDI, Munich DM 25.45

A summary of publications is presented based mainly on the needs of the exploration activities which started 5 years ago; it includes nearly all the papers and reports of manganese nodules available, as well as selected publications of general importance for the exploration practice concerning the properties of environment (water column, sediment, topography) and the technical aspects of developing (exploration techniques, mining, metallurgy, economy, legal problems). A special classification code is used as an aid for orientation within the main topics.
Author (ESA)

N76-24655*# Oregon State Univ., Corvallis.
THE IDENTIFICATION OF SELECTED VEGETATION TYPES IN ARIZONA THROUGH THE PHOTOINTERPRETATION OF INTERMEDIATE SCALE AERIAL PHOTOGRAPHY M.S. Thesis
George Franklin Ross, Principal Investigator Dec. 1973 155 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21831)
(E76-10300; NASA-CR-146793) Avail: NTIS HC $6.75 CSCL 08F

The author has identified the following significant results. Nine photography interpretation tests were performed with a total of 19 different interpreters. Three tests were conducted with black and white intermediate scale photography and six tests with color infrared intermediate scale photography. The black and white test results show that the interpretation of vegetation mapped at the association level of classification is reliable for all the classes used at 61%. The color infrared tests indicate that the association level of mapping is unsatisfactory for vegetation interpretation of classes 1 and 6. Students' t-test indicated that intermediate scale black and white photography is significantly better than this particular color infrared photography for the interpretation of southeastern Arizona vegetation mapped at the association level.

N76-24656*# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
REGIONAL TECTONIC EVALUATION OF THE TUSCAN APENINE, VULCANISM, THERMAL ANOMALIES AND THE RELATION TO STRUCTURAL UNITS Final Report, Oct. 1972 - May 1975
J. Bodechtel, Principal Investigator May 1975 146 p refs Sponsored by NASA and Deutsche Forschungsgemeinschaft Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10331; NASA-CR-147212) Avail: NTIS HC $6.00 CSCL 08F

The author has identified the following significant results. The geological interpretation on data exhibiting the Italian peninsula led to the recognition of tectonic features which are explained by a clockwise rotation of various blocks along left-handed transform faults. These faults can be interpreted as resulting from shear due to main stress directed north-eastwards. A land use map of the mountainous regions of Italy was produced on a scale of 1:250,000. For the digital treatment of MSS-CCTs an image processing software was written in FORTRAN 4. The software package includes descriptive statistics and also classification algorithms.

N76-24657*# Ohio Dept. of Economic and Community Development, Columbus.
DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO Progress Report
Paul E. Baldridge, Principal Investigator 10 Mar. 1976 4 p ref ERTS
(Contract NAS5-22399)
(E76-10334; NASA-CR-147218; PR-3) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-24658*# Sheffield Univ. (England). Dept. of Geography.
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. 1: INTRODUCTION
J. L. VanGenderen, Principal Investigator and B. F. Lock Jan. 1976 7 p refs Sponsored by NASA EREP
(E76-10338; NASA-CR-147221) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. This research program has developed a viable methodology for producing small scale rural land use maps in semi-arid developing countries using imagery obtained from orbital multispectral scanners.

N76-24659*# Sheffield Univ. (England). Dept. of Geography
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. 2: CAPABILITIES OF REMOTE SENSING TECHNIQUES FOR LAND USE SURVEYS
J. L. VanGenderen, Principal Investigator and B. F. Lock Feb. 1976 21 p refs Sponsored by NASA EREP
(E76-10339; NASA-CR-147222) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-24660*# Milan Univ. (Italy).
GEOMORPHIC AND LANDFORM SURVEY OF NORTHERN APPENNINI Quarterly Report
Carlo M. Marino, Principal Investigator 19 Feb. 1976 8 p Sponsored by NASA ERTS
(E76-10340; NASA-CR-147223; QR-2) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-24661*# Norsk Polarinstitutt, Oslo.
GLACIOLOGICAL AND MARINE BIOLOGICAL STUDIES AT PERIMETER OF DRONNING MAUD LAND, ANTARCTICA Progress Report
Olav Orheim, Principal Investigator 27 May 1976 5 p Sponsored by NASA and Roy. Norwegian Council for Sci. and Industrial Res. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10341; NASA-CR-147225; QPR-3) Avail: NTIS HC $3.50 CSCL 08A

There are no author-identified significant results in this report.

N76-24662*# Ohio Dept. of Economic and Community Development, Columbus.
THE OHIO LAND ALLOCATION MODEL: REPORT ON PHASE 1
Oscar Fisch, Principal Investigator and Steven I. Gordon Jan. 1976 81 p refs ERTS
(Contract NAS5-22399)
(E76-10342; NASA-CR-147234) Avail: NTIS HC $5.00 CSCL 08B

There are no author-identified significant results in this report.

N76-24663*# Kansas Univ., Lawrence. Space Technology Center.
A COMPREHENSIVE DATA PROCESSING PLAN FOR CROP CALENDAR MSS SIGNATURE DEVELOPMENT FROM SATELLITE IMAGERY Progress Report
R. M. Haralick, Principal Investigator 1 Apr. 1976 177 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20943)
(E76-10343; NASA-CR-147235; TR-286-2; PR-2) Avail: NTIS HC $7.50 CSCL 05B

There are no author-identified significant results in this report.

N76-24664*# Nebraska Univ., Lincoln.
THE USE OF LANDSAT-1 IMAGERY IN MAPPING AND MANAGING SOIL AND RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA Final Report, Jun. 1972 - May 1974
Paul M. Seevers, Principal Investigator and James V. Drew Jan. 1976 86 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21756)
(E76-10344; NASA-CR-147236) Avail: NTIS HC $5.00 CSCL 08B

The author has identified the following significant results. Evaluation of ERTS-1 imagery for the Sand Hills region of Nebraska has shown that the data can be used to effectively measure several parameters of inventory needs. (1) Vegetative biomass can be estimated with a high degree of confidence using computer compatable tape data. (2) Soils can be mapped to the subgroup level with high altitude aircraft color infrared photography and to the association level with multitemporal ERTS-1 imagery. (3) Water quality in Sand Hills lakes can be estimated utilizing computer compatable tape data. (4) Center pivot irrigation can be inventoried from satellite data and can be monitored regarding site selection and relative success of establishment from high altitude aircraft color infrared photography. (5) ERTS-1 data is of exceptional value in wide-area inventory of natural resource data in the Sand Hills region of Nebraska.

N76-24665*# Wyoming Univ., Laramie. Dept. of Geology.
APPLICATION LANDSAT IMAGERY TO GEOLOGIC MAPPING IN THE ICE-FREE VALLEYS OF ANTARCTICA Final Report, Jul. 1972 - Feb. 1976
Robert S. Houston, Principal Investigator, Ronald W. Marrs, and Scott B. Smithson Feb. 1976 73 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21818)
(E76-10345; NASA-CR-147237) Avail: NTIS HC $4.50 CSCL 08G

The author has identified the following significant results. Studies in the Ice-Free Valleys are resulted in the compilation of a sizeable library of maps and publications. Rock reflectance measurements were taken during the Antarctic summer of 1973. Spectral reflectance of rocks (mostly mafic lava flows) in the McMurdo and Ice-Free Valleys areas were measured using a filter wheel photometer equipped to measure reflectances in the four Landsat bands. A series of samples were collected at regular intervals across a large differentiated, mafic sill near Lake Vida. Chemical analyses of the sample suggest that the tonal variations in this sill are controlled by changes in the iron content of the rock. False color images were prepared for a number of areas by the diazo method and with an optical multispectral biviewer. These images were useful in defining boundaries of sea ice, snow cover, and in the study of ablating glaciers, but were not very useful for rock discrimination.

N76-24666*# TRW Systems Group, Redondo Beach, Calif.
FUNCTIONAL DESIGN FOR OPERATIONAL EARTH RESOURCES GROUND DATA PROCESSING Final Report, 6 Dec. 1971 - 6 Sep. 1972
C. J. Baldwin, Principal Investigator, L. H. Bradford, D. E. Hutson, and D. R. Jugle 15 Sep. 1972 121 p EREP
(Contract NAS9-12336)
(E76-10346; NASA-CR-147656) Avail: NTIS HC $5.50 CSCL 05B

The author has identified the following significant results. Study emphasis was on developing a unified concept for the required ground system, capable of handling data from all viable acquisition platforms and sensor groupings envisaged as supporting operational earth survey programs. The platforms considered include both manned and unmanned spacecraft in near earth orbit, and continued use of low and high altitude aircraft. The sensor systems include both imaging and nonimaging devices, operated both passively and actively, from the ultraviolet to the microwave regions of the electromagnetic spectrum.

N76-24667*# Geological Survey, Reston, Va.
PROCESSING OF LANDSAT IMAGERY FOR DISSEMINATION PURPOSES Progress Report, 18 Aug. 1975 - 1 May 1976
Alden P. Colvocoresses, Principal Invesigator and Hugh B. Loving 15 Apr. 1976 5 p ERTS
(NASA Order S-539-99)
(E76-10347; NASA-CR-147238) Avail: NTIS HC $3.50 CSCL 05B

The author has identified the following significant results. The differentiation between bands 4 and 5 was achieved through enhancement. Depiction of dormant vegetation on the upper Chesapeake Bay image map in tones of green is an example of significant difference between bands 4 and 5 which can be achieved through proper enhancement.

N76-24668*# Geological Survey, Reston, Va.
OVERALL EVALUATION OF LANDSAT (ERTS) FOLLOW-ON IMAGERY FOR CARTOGRAPHIC APPLICATION Progress Report, 20 May 1975 - 1 Apr. 1976
Alden P. Colvocoresses, Principal Investigator 1 Apr. 1976 11 p refs ERTS
(NASA Order S-543-748)
(E76-10348; NASA-CR-147239) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. The NASA/Cousteau experiment showed that under suitable conditions and with calibration data, the bottom of clear tropical seas can be mapped with LANDSAT to a depth of 22 meters with a root-mean-square error of about 10 percent. This application required the high gain setting of band 4 of the MSS. The experiment also confirmed that a somewhat lower waveband than band 4 would increase the water penetration capability of future LANDSATS. Other experiments illustrated by the reprinting of upper Chesapeake Bay indicate that the original LANDSAT signals must be modulated and optimized for the photographic and lithographic processes. Work by the Canadian mapping agency indicates significant improvements in the control identification and geometric accuracy of LANDSAT cartographic applications.

N76-24669*# Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM LANDSAT DATA Progress Report, 1 Feb. - 30 Apr. 1976
M. Griggs, Principal Investigator 1 May 1976 14 p ERTS
(Contract NAS5-20899)
(E76-10349; NASA-CR-147240; SAI-76-595-LJ; PR-5) Avail: NTIS HC $3.50 CSCL 04A

There are no author-identified significant results in this report.

N76-24670*# National Marine Fisheries Service, Bay Saint Louis, Miss.
LANDSAT MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION Progress Report, 31 Jan. - 30 Apr. 1976
Kenneth Savastano, Principal Investigator, Andres J. Kemmerer (NASA. Slidell Computer Complex), and Kenneth Faller May 1976 35 p refs EREP
(NASA Order S-54114)
(E76-10350; NASA-CR-147241; SEFC-Contrib-454; MARMAP-Contrib-119; Rept-3) Avail: NTIS HC $4.00 CSCL 08A

The author has identified the following significant results. The most significant achievement is the successful charting of high probability fishing areas from LANDSAT MSS data.

N76-24671*# Zurich Univ. (Switzerland). Dept. of Geography.
NATURAL RESOURCES INVENTORY AND LAND EVALUATION IN SWITZERLAND Quarterly Report
Harold Haefner [1975] 5 p refs Sponsored by NASA ERTS
(E76-10351; NASA-CR-147243; QR-3) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-24672*# Department of Surveys and Lands, Gaborone (Botswana).
AN AID TO THE DEVELOPMENT OF BOTSWANA'S RESOURCES Progress Report
William L. Dickson, Principal Investigator and J. A. Raffle Apr. 1976 8 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10352; NASA-CR-147244; QPR-1) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-24673*# Department of Surveys and Lands, Gaborone (Botswana).
AN AID TO THE DEVELOPMENT OF BOTSWANA'S RESOURCES: SECTION ON HYDROLOGY Quarterly Report
William L. Dickson, Principal Investigator and Brian Harold Wilson May 1976 6 p Revised Sponsored by NASA ERTS
(E76-10353; NASA-CR-147245) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. It is proved that FCC's can be used for a simple estimate of the total evaportranspiring area of the Okavango Delta, sufficiently accurate for preliminary inputs for the development of mathematical model of the surface hydrology of the delta. The color coded matrix has shown as interesting inverse correlation with an array on the same grid prepared by ecologists from air photography study, for percent liable to flood.

N76-24674*# Department of the Environment, Ottawa (Ontario). Applied Hydrology Div.
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Jan. - Mar. 1976
R. A. Halliday, Principal Investigator and I. A. Reid Apr. 1976 11 p ERTS
(E76-10354; NASA-CR-147246) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. The project continues to demonstrate the feasibility of transmitting hydrometric data to polar orbiting spacecraft and using these data on a quasi-operational basis. The implementation of the receive site in Alaska in December 1975 has significant impact on the Canadian experiment as the number of transmissions received from some northern and northwestern sites has increased substantially.

N76-24675*# Academy of Scientific Research and Technology, Cairo (Egypt).
REGIONAL PROSPECTING FOR IRON ORES IN BAHARIYA OASIS-EL FAIYUM AREA, EGYPT, USING LANDSAT SATELLITE IMAGES, PART 1
M. A. Abdel-Hady, Principal Investigator, E. M. El Shazly, M. A. El Ghawaby, and S. M. Khawasik 29 Feb. 1976 56 p refs Sponsored by NASA ERTS
(E76-10355; NASA-CR-147247) Avail: NTIS HC $4.50 CSCL 08G

There are no author-identified significant results in this report.

N76-24676*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND ENVIRONMENTAL RESOURCES INVESTIGATIONS IN EGYPT USING LANDSAT IMAGES Progress Report
M. A. Abdel-Hady, Principal Investigator [1975] 16 p refs Sponsored by NASA ERTS
(E76-10356; NASA-CR-147248; QPR-1) Avail: NTIS HC $3.50 CSCL 08G

There are no author-identified significant results in this report.

N76-24677*# Servicio Geologico de Bolivia, La Paz.
THE 29950 EARTH RESOURCE TECHNOLOGY SATELLITE (ERTS-A) SENSOR DATA FOR MINERAL RESOURCE SECTOR DEVELOPMENT AND REGIONAL LAND USE SURVEY Quarterly Report, Nov. 1975 - Mar. 1976
Carlos E. Brockmann, Principal Investigator Mar. 1976 15 p Sponsored by NASA Original contains color illustrations ERTS
(E76-10357; NASA-CR-147915) Avail: NTIS HC $3.50 CSCL 08G

There are no author-identified significant results in this report.

N76-24678*# Earthsat Corp., Washington, D.C.
EARTHSAT SPRING WHEAT YIELD SYSTEM TEST 1975, APPENDIX 4
Apr. 1976 331 p refs
(Contract NAS9-14655)
(NASA-CR-147712; E/S-1052-App-4) Avail: NTIS HC $10.00 CSCL 02C

A computer system is presented which processes meteorological data from both ground observations and meteorologic satellites to define plant weather aspects on a four time per day basis. Plant growth stages are calculated and soil moisture profiles are defined by the system. The EarthSat system assesses plant stress and prepares forecasts of end-of-year yields. The system was used to forecast spring wheat yields in the upper Great Plains states. Hardware and software documentation is provided. A.S.K.

N76-24679*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
ON SIMILARITY TRANSFORMATION AND GEODETIC NETWORK DISTORTIONS BASED ON DOPPLER SATELLITE OBSERVATIONS
Alfred Leick and Boudewijn H. W. VanGelder Dec. 1975 151 p refs
(Grant NGR-36-008-204; OSURF Proj. 3820-A1)
(NASA-CR-147152; Rept-235) Avail: NTIS HC $6.75 CSCL 08B

Models used in geodesy to transform two sets of coordinates are studied and distortions in geodetic networks are investigated. Commonly used transformation models are first reviewed and most of them are interpreted. Differences between various models are discussed. Pitfalls in partial solutions are then considered. It is shown that only as many chords and/or directional elements can be used in the computation as are needed to completely determine the size or shape of the polyhedron implied in the set of Cartesian coordinates. Each additional element causes the normal matrix to be singular provided that all correlations between the chords are used. A number of tables and maps indicating distortions in the NAD 27, Precise Traverse M-R '72, AUS, and SAD 69 geodetic datums are also included. The residuals of the coordinates are scanned for systematic patterns after transforming each geodetic system to the NWL9D Doppler system. Also, an attempt is made to show scale distortions in the NAD 27. Author

N76-24680*# Old Dominion Univ., Norfolk, Va. Dept. of Biology.
MAPPING FOREST VEGETATION WITH ERTS-1 MSS DATA AND AUTOMATIC DATA PROCESSING TECHNIQUES
J. Messmore, G. E. Copeland, and G. F. Levy [1975] 18 p refs
(Grant NGL-47-003-067)
(NASA-CR-148136) Avail: NTIS HC $3.50 CSCL 08B

This study was undertaken with the intent of elucidating the forest mapping capabilities of ERTS-1 MSS data when analyzed with the aid of LARS' automatic data processing

techniques. The site for this investigation was the Great Dismal Swamp, a 210,000 acre wilderness area located on the Middle Atlantic coastal plain. Due to inadequate ground truth information on the distribution of vegetation within the swamp, an unsupervised classification scheme was utilized. Initially pictureprints, resembling low resolution photographs, were generated in each of the four ERTS-1 channels. Data found within rectangular training fields was then clustered into 13 spectral groups and defined statistically. Using a maximum likelihood classification scheme, the unknown data points were subsequently classified into one of the designated training classes. Training field data was classified with a high degree of accuracy (greater than 95 percent), and progress is being made towards identifying the mapped spectral classes. Author

N76-24681*# Old Dominion Univ., Norfolk, Va. Dept. of Physics and Geophysical Sciences.
USE OF LARS SYSTEM FOR THE QUANTITATIVE DETERMINATION OF SMOKE PLUME LATERAL DIFFUSION COEFFICIENTS FROM ERTS IMAGES OF VIRGINIA
R. N. Blais, G. E. Copeland, and T. H. Lerner [1975] 13 p refs
(Grant NGL-47-003-067)
(NASA-CR-148137) Avail: NTIS HC $3.50 CSCL 13B

A technique for measuring smoke plume of large industrial sources observed by satellite using LARSYS is proposed. A Gaussian plume model is described, integrated in the vertical, and inverted to yield a form for the lateral diffusion coefficient, Ky. Given u, wind speed; y sub I, the horizontal distance of a line of constant brightness from the plume symmetry axis a distance x sub I, downstream from reference point at x=x sub 2, y=0, then K sub y = u ((y sub 1) to the 2nd power)/2 x sub 1 1n (x sub 2/x sub 1). The technique is applied to a plume from a power plant at Chester, Virginia, imaged August 31, 1973 by LANDSAT I. The plume bends slightly to the left 4.3 km from the source and estimates yield Ky of 28 sq m/sec near the source, and 19 sq m/sec beyond the bend. Maximum ground concentrations are estimated between 32 and 64 ug/cu m. Existing meteorological data would not explain such concentrations. Author

N76-24682# Committee on the Judiciary (U. S. Senate).
OUTER CONTINENTAL SHELF OIL AND GAS DEVELOPMENT
Washington GPO 1975 303 p refs Joint Hearings before Subcomm. on Administrative Practice and Procedure of Comm. on the Judiciary and the Natl. Ocean Policy Study of Comm. on Commerce, 93d Congr., 2d Sess., 5 Aug., 7 Oct. 1974
(GPO-44-827) Avail: Subcomm. on Administrative Practice and Procedure

Testimony concerning the feasibility of leasing well sites on the outer continental shelf for oil and gas development is presented. Topics for discussion included economic and environmental considerations regarding proposed oil exploration off the Massachusetts coast. Presentations were made by representatives of government, the scientiffc community and lobbyists for environmental groups. A.S.K.

N76-24683*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS OF SOIL MOISTURE FLIGHTS DURING APRIL 1974
Thomas J. Schmugge, Bruce J. Blanchard, William J. Burke, Jack F. Paris, and James R. Swang Washington May 1976 58 p refs
(NASA-TN-D-8199; G-7663) Avail: NTIS HC $4.50 CSCL 08M

The results presented here are derived from measurements made during the April 5 and 6, 1974 flights of the NASA P-3A aircraft over the Phoenix, Arizona agricultural test site. The purpose of the mission was to study the use of microwave techniques for the remote sensing of soil moisture. These results include infrared (10-to 12 micrometers) 2.8-cm and 21-cm brightness temperatures for approximately 90 bare fields. These brightness temperatures are compared with surface measurements of the soil moisture made at the time of the overflights. These data indicate that the combination of the sum and difference of the vertically and the horizontally polarized brightness temperatures yield information on both the soil moisture and surface roughness conditions. Author

N76-24684*# Pennsylvania Univ., Philadelphia. Dept. of Geology.
MICROPROBE AND OXYGEN FUGACITY STUDY OF ARMALCOLITE Final Technical Report
John J. Friel 14 Jun. 1976 33 p refs
(Grant NsG-7119)
(NASA-CR-148134) Avail: NTIS HC $4.00 CSCL 08G

The stability of synthetic armalcolite was determined as a function of oxygen fugacity with particular regard to the oxidation state of iron and titanium. The equilibrium pseudobrookite (armalcolite) composition was measured at 1200 C under various conditions of oxidation typical of the lunar environment. These data, when compared with published descriptions of mare basalts, provide information about the conditions of crystallization of armalcolite-bearing lunar rocks. Some information about the crystal chemistry of armalcolite was obtained from X-ray diffraction and electron microprobe analyses of synthetic armalcolite and Zr-armalcolite. Further data were gathered from a comparison of the Mossbauer spectra of a phase pure stoichiometric armalcolite and one containing appreciable amounts of trivalent titanium. Author

N76-24685*# Lockheed Electronics Co., Houston, Tex.
A NEW COMPUTER APPROACH TO MIXED FEATURE CLASSIFICATION FOR FORESTRY APPLICATION
E. P. Kan Apr. 1976 31 p refs
(Contract NAS9-12200)
(NASA-CR-147747; LEC-8061; JSC-11034) Avail: NTIS HC $4.00 CSCL 02F

A computer approach for mapping mixed forest features (i.e., types, classes) from computer classification maps is discussed. Mixed features such as mixed softwood/hardwood stands are treated as admixtures of softwood and hardwood areas. Large-area mixed features are identified and small-area features neglected when the nominal size of a mixed feature can be specified. The computer program merges small isolated areas into surrounding areas by the iterative manipulation of the postprocessing algorithm that eliminates small connected sets. For a forestry application, computer-classified LANDSAT multispectral scanner data of the Sam Houston National Forest were used to demonstrate the proposed approach. The technique was successful in cleaning the salt-and-pepper appearance of multiclass classification maps and in mapping admixtures of softwood areas and hardwood areas. However, the computer-mapped mixed areas matched very poorly with the ground truth because of inadequate resolution and inappropriate definition of mixed features. Author

N76-24686*# Lockheed Electronics Co., Houston, Tex.
AN AD HOC MAP EVALUATION PROCEDURE
E. P. Kan Apr. 1976 35 p refs
(Contract NAS9-12200)
(NASA-CR-147746; LEC-8278; JSC-11154) Avail: NTIS HC $4.00 CSCL 08B

An ad hoc map evaluation procedure is proposed which is most suitable for evaluating low-resolution classification maps against high resolution ground truth maps, such as maps against interpreted aircraft photographs. Commonly practiced sampling and evaluation procedures are impracticable in this context because of difficulties in registration and in comparing the samples. This ad hoc procedure is designed to overcome these two major problems, and its practicability is discussed. Two widely accepted parameters are estimated by the new procedure; namely, the probability of correct classification and the proportion biases. Statistical qualifications are also provided. Author

N76-24687# Bristol Univ. (England). Dept. of Electrical Engineering.
SIMULATION OF FLOOD WAVES IN CHANNELS Ph.D. Thesis
S. Huntington Apr. 1975 234 p refs
Avail: NTIS HC $8.00

Problems associated with the effects of modifying flood plains in a channel system which is expected to carry an accentuated hydrograph are dealt with in the context of urbanization of an area susceptible to flooding. Both physical and numerical model

studies were carried out in order to study the effectiveness of flood plains in controlling flood levels. Results from the physical model indicate in a qualitative manner the performance of various geometries of flood plain and the effect of downstream controls. On the basis of available data, the numerical model is shown to simulate the physical model results sufficiently well to justify application of the basic techniques to flood wave propagation in real rivers. ESA

N76-24688# World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL AND HYDROLOGICAL DATA REQUIRED IN PLANNING THE DEVELOPMENT OF WATER RESOURCES (PLANNING AND DESIGN LEVEL)
V. G. Andrejanov 1975 48 p refs
(WMO-419; OHR-5; ISBN-92-63-10419-0) Avail: NTIS HC $4.00; WMO, Geneva Sw. Fr.10

The meteorology for calculating meteorological and hydrological characteristics and parameters is discussed together with methods of calculating individual elements of the hydrometeorological regime. A summary of the characteristics and parameters required in the planning of various structures and measures for diverse types of water resource use is also included. ESA

N76-24689# World Meteorological Organization, Geneva (Switzerland).
HYDROLOGICAL FORECASTING PRACTICES
A. I. Afanasiev and T. J. Nordenson, ed. 1975 149 p refs
(WMO-425; OHR-6; ISBN-92-63-10425-5) Avail: NTIS HC $6.00

The basic principles of, and approaches to, hydrological forecasting are summarized. Specific types of hydrological forecasts are described in detail. These include: forecasting rainfall-induced floods, flood prediction in lower river reaches and snow-melt induced floods; prediction of water supply over long periods of time; forecast of low flows in rivers; and ice freeze and break-up prediction. An evaluation of the effectiveness of forecasting methods and of the degree of success of operational hydrological forecasts is also included. ESA

N76-24690# World Meteorological Organization, Geneva (Switzerland).
INTERCOMPARISON OF CONCEPTUAL MODELS USED IN OPERATIONAL HYDROLOGICAL FORECASTING Final Report
1975 197 p refs
(WMO-429; OHR-7; ISBN-92-63-10429-8) Avail: NTIS HC $7.50

The aim and implementation of the intercomparison project are outlined and a generalized description of models submitted is given. The standard data sets used in the project and spin limitations as well as the data requirements of various models are discussed. The graphical and numerical verification results of the simulations produced by the tested models are reviewed together with evaluations of the limits of application of the models and the river basins on which they were tested. ESA

N76-24691# Cincinnati Univ., Ohio.
FACTORS AFFECTING DEVELOPMENT, AND OPTIMAL PHOTOMAPPING TECHNIQUE, OF CALCIUM CARBONATE CEMENTATION OF ARID REGION SEDIMENTS Final Report, Jul. 1971 - Sep. 1975
Laurence H. Lattman 6 Oct. 1975 30 p refs
(Grant DA-ARO(D)-31-124-71-G137)
(AD-A018959; ARO-9876.2-G5) Avail: NTIS CSCL 08/7

Caliche (secondary calcium carbonate cementation) occurs as six different types in southern Nevada. Two of these types, petrocalcic horizons and laminar layers, markedly reduce infiltration on alluvial fans and increase flooding hazards. The most important factor apparently controlling development of caliche in the southwestern United States is the lithology of the alluvial fan detritus. Availability of eolian dust, containing calcite and gypsum, and increasing age of the deposit are factors which increase calichification. The thickest caliche deposits are adjacent to or downwind from gypsum outcrops. Using black-and-white film and filter combinations it was found that an orange filter gave the most reliable results in distinguishing calichified from non-calichified fans. A blue filter gave greatest contrast between calichified fan surfaces and uncalichified modern drainage washes. Because of variation in caliche types, no clear correlation was found between degree of calichification and photographic expression. GRA

N76-24692# Bendix Research Labs., Southfield, Mich.
OFF-LINE ORTHOGRAPHIC PRINTER EDITING SOFTWARE Final Report, May 1974 - Jul. 1975
J. P. Szafranski, W. F. Derouchie, and W. E. Steinman Nov. 1975 106 p
(Contract F30602-74-C-0251; AF Proj. 5569)
(AD-A018911; BRL-7829; RADC-TR-75-285) Avail: NTIS CSCL 08/2

This report illustrates an extension to the concept of off-line orthophoto generation by offering a higher quality product, a simpler control computer design and a more versatile means of terrain and image related data manipulation. To accomplish these features the present orthoprinter control programs were functionally separated such that the control computer was responsible for image generation only. The aspects of terrain data editing and orthoprinter coordinate derivation were derived off-line. A PDP 11/45 program reads the standard AS-11B-1 terrain data tape, performs terrain data manipulation, image positioning and correction under operator control, and writes a new error-free magnetic tape for use on the Off-Line Orthographic Printer (OOP). In the second step, the OOP control computer reads the command data on magnetic tape and uses it to print high quality photographic imagery commensurate with the previous standards. GRA

N76-24693# Naval Surface Weapons Center, Dahlgren, Va.
LONG TERM CONSISTENCY IN POSITION OF SITES DETERMINED FROM DOPPLER SATELLITE OBSERVATIONS Final Report
R. J. Anderle Nov. 1975 59 p refs
(AD-A019522; NSWC/DL-TR-3433) Avail: NTIS CSCL 08/5

Doppler observations of artificial satellites made by mobile receivers have been used to determine the positions of navigation beacons and other isolated sites since 1963. Over this period, improvements in the accuracy of the satellite net of 15 to 20 base stations have yielded an improvement in the computed positions of the isolated sites from 100m to an estimated 1m. This report compares positions of the base stations computed from observations made over the past twelve years using recent geodetic parameters and methods to determine if systematic variations exist in computed positions. GRA

N76-24694# Fort Valley State Coll., Ga. Div. of Agriculture.
WATER RESOURCES: UTILIZATION AND CONSERVATION IN THE ENVIRONMENT Final Report, Feb. - Aug. 1975
M. C. Blount Aug. 1975 479 p refs
(Grant EPA-R-803107)
(PB-247612/5; EPA-600/9-75-006) Avail: NTIS CSCL 13B

Proceedings are given of the Southeast Region Water Resources Symposium held at Fort Valley State College on February 28 to March 1, 1974. The symposium covered comprehensively agriculture's involvement with water: conservation and management of supplies, hazards to water quality and some means of controlling them, and urban erosion control where rural erosion control practices are finding application. GRA

N76-24695# Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Economics.
ENERGY DEMAND AND WATER RESOURCE MANAGEMENT: SOME ECONOMIC ASPECTS Completion Report
Donna K. Lyon Dec. 1975 135 p refs
(Contract DI-14-31-0001-5096)
(PB-248456/6; AE-Res-75-32; W76-03003; OWRT-B-045-NY(1)) Avail: NTIS HC $6.00 CSCL 13B

A general economic model is developed which uses mixed integer programming to minimize the cost of water withdrawals to the electricity generating industry. The model is placed in the context of a river basin and indicates the amount of water to be allocated for power plant cooling systems, given an exogenously determined level of electricity demand. The model may be expanded in order to analyze other policies and to include other sectors in the objective function, in addition to the electricity industry. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-24696* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ENERGY TRAP Patent
Lott W. Brantley, Jr., inventor (to NASA) Issued 25 May 1976 22 p Filed 29 Oct. 1974
(NASA-Case-MFS-22744-1; US-Patent-3,958,553; US-Patent-Appl-SN-518544; US-Patent-Class-126-270; US-Patent-Class-126-271; US-Patent-Class-350-293; US-Patent-Class-350-299) Avail: US Patent Office CSCL 10A

An apparatus is described for trapping solar energy for heating a fluid that could be subsequently used in turbines and similar devices. The apparatus includes an elongated vertical light pipe having an open end through which the visible spectrum of electromagnetic radiation from the sun passes to strike a tubular absorber. The light pipe has a coated interior surface of a low absorptivity and a high reflectivity at the visible wavelengths and a high absorptivity/emissivity ratio at infrared wavelengths. The tubular absorber has a coating on the surface for absorbing visible wavelengths to heat the fluid passing through. Infrared wave lengths are radiated from the tubular absorber back into the light pipe for heating fluid passing through a tubular coil wound around it. Official Gazette of the U.S. Patent Office

N76-24697*+ New Mexico Univ., Albuquerque. Technology Application Center.
QUARTERLY LITERATURE REVIEW OF HYDROGEN ENERGY: A BIBLIOGRAPHY WITH ABSTRACTS, FOURTH QUARTER 1975 Quarterly Update
31 Dec. 1975 56 p Sponsored by NASA
(NASA-CR-147972) Copyright. Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 10B

This bibliography lists 337 reports, articles, and other documents introduced into the NASA scientific and technical information system from January 1, 1975 through March 31, 1975. Author

N76-24698 British Library Lending Div., Boston Spa (England).
LARGE NUCLEAR POWER STATIONS OF THE FUTURE AND ENVIRONMENTAL CONSTRAINTS
M. Widmer et al [1975] 18 p Transl. into ENGLISH from French report Presented at 9th World Energy Conf., Detroit, 22-27 Sep. 1974
(BLL-CE-Trans-6684-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The unit capacity of nuclear power stations can be expected to increase further in the future. The problem of the cooling supply is therefore of primary importance and is bound to affect the design of power stations, their thermodynamic cycles and the generating plant. A solution is proposed which consists of using a bindary water-ammonia cycle, with direct condensation of the ammonia in dry cooling towers. It is shown that this solution is feasible and solves the problems of thermal pollution and large output. It also gives much greater freedom in the choice of sites: reduction in transmission costs, possibility of siting stations in uninhabitable areas, etc. The study also considers the economic aspects and concludes that, as regards France and the medium-term nuclear future, this technique, by virtue of the freedom it provides with regard to the choice of sites, may lead to a satisfactory solution. Author

N76-24699 British Library Lending Div., Boston Spa (England).
GAS TURBINES AT VILLEJUST AND VITRY POWER STATIONS. PART 2: VITRY
A. Mache [1975] 22 p Transl. into ENGLISH from Tech. Mod. (Paris), no. 3, Mar. 1974 p 31-37
(BLL-CE-Trans-6775-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Gas turbines were combined with conventional 250 MW units at the Vitry power plant in order to reduce the costs of installing peak-load capacity. The gas turbines of the system are described in detail. Preliminary operating results are given indicating that the system is cost effective. J.M.S.

N76-24700# Committee on Interior and Insular Affairs (U. S. Senate).
GREATER COAL UTILIZATION, PART 1
Washington GPO 1975 795 p refs Joint Hearings on S. 1777 before Comm. on Interior and Insular Affairs and Comm. on Public Works, 94th Congr., 1st Sess., 10-11 Jun. 1975
(GPO-55-305) Avail: Comm. on Interior and Insular Affairs

Testimony concerning proposed legislation to require new industrial boilers and power plants to utilize coal as an energy source is presented. Statements of representatives from the coal industry, electric utilities, government, and the railroads are presented. Also included are environmental and economic impact reports and coal resource surveys. A.S.K.

N76-24701# Committee on Interior and Insular Affairs (U. S. Senate).
GREATER COAL UTILIZATION, PART 2
Washington GPO 1975 919 p refs Joint Hearings on S. 1777 before Comm. on Interior and Insular Affairs and Comm. on Public Works, 94th Congr., 1st Sess., 12, 16, and 23 Jun. 1975
(GPO-55-305) Avail: Comm. on Interior and Insular Affairs

Additional testimony concerning proposed legislation to require new industrial boilers and power plants to utilize coal as an energy source is presented. Statements of representatives from the coal industry, electric utilities, government, industry, and the railroads are presented. Also included are environmental and economic impact reports and coal resource surveys. A.S.K.

N76-24702*# Chrysler Corp., Cape Canaveral, Fla.
DEVELOPMENT OF A SOLAR POWERED RESIDENTIAL AIR CONDITIONER (GENERAL OPTIMIZATION) Final Report
D. J. Lowen Mar. 1976 153 p refs
(Contract NAS8-31437)
(NASA-CR-144314) Avail: NTIS HC $6.75 CSCL 13B

A commercially available 3-ton residential Lithium Bromide (LiBr) absorption air conditioner was modified for use with lower temperature solar heated water. The modification included removal of components such as the generator, concentration control chamber, liquid trap, and separator; and the addition of a Chrysler designed generator, an off-the-shelf LiBr-solution pump. The design goal of the modified unit was to operate with water as the heat-transfer fluid at a target temperature of 85 C (185 F). 29.4 C (85 F) cooling water inlet, producing 10.5 kW (3 tons) of cooling. Tests were performed on the system before and after modification to provide comparative data. At elevated temperatures (96 C, 205 F), the test results show that Lithium Bromide was carried into the condenser due to the extremely violent boiling and degraded the evaporator performance. Author

N76-24703*# Coppin State College, Baltimore, Md.
CADMIUM MIGRATION IN AEROSPACE NICKEL CADMIUM CELLS
Patrick P. McDermott Greenbelt, Md. NASA Mar. 1976 32 p refs
(Grant NsG-5051)
(NASA-CR-144753) Avail: NTIS HC $4.00 CSCL 10C

The effects of temperature, the nature of separator material, charge and discharge, carbonate contamination, and the mode of storage are studied with respect to the migration of active material from the negative toward the positive plate. A theoretical model is proposed which takes into account the solubility of cadmium in various concentrations of hydroxide and carbonate at different temperatures, the generation of the cadmiate ion. Cd(OH)3(-), during discharge, the migration of the cadmiate ion and particulate Cd(OH)2 due to electrophoretic effects and the movement of electrolyte in and out of the negative plate and finally, the recrystallization of cadmiate ion in the separator as

Cd(OH)2. Application of the theoretical model to observations of cadmium migration in cycled cells is also discussed. Author

N76-24704*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1975 GSFC BATTERY WORKSHOP
Nov. 1975 342 p Conf. held at Greenbelt, Md., 11-12 Nov. 1975
(NASA-TM-X-71104; X-711-76-21) Avail: NTIS HC $10.00 CSCL 10C

The proceedings of the 1975 Goddard Space Flight Center Battery Workshop are presented. The major topics of discussion were nickel cadmium batteries and, to a lesser extent, nickel hydrogen batteries. Battery design, manufacturing techniques, testing programs, and electrochemical characteristics were considered. The utilization of these batteries for spacecraft power supplies was given particular attention. D.M.L.

N76-24705# Select Committee on Small Business (U. S. House).
PHASE 4 OIL REGULATIONS AND PETROLEUM MARKETING PROBLEMS. PART 2: MANDATORY ALLOCATION AND DISTRIBUTION PROBLEMS
Washington GPO 1974 256 p refs Hearings before Subcomm. on Activities of Regulatory Agencies of Permanent Select Comm. on Small Business, 93d Congr., 2d Sess., 19-21 Mar. 1974
(GPO-32-811) Avail: Subcomm. on Activities of Regulatory Agencies

Testimony concerning the effects of mandatory oil allocations on small businesses is presented. The government, the oil production industry, and gasoline retailers were represented. A.S.K.

N76-24706# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
CURRENT TRANSFORMATION AND FIELD SCREENING WITH SUPERCONDUCTING COILS
M. Scherer and P. Turowski [1975] 24 p refs Transl. into ENGLISH from the German report KFK-2064
(ERDA-tr-85; KFK-2064) Avail: NTIS HC $3.50

Investigations on the inductive generation of electrical currents in superconducting coils are reported. The induced currents are limited by the I/sub c/, B curve of the superconductor so that they break down at certain values of magnetic field. After each breakdown, a current is induced again if the field increases continuously. From an examination of the current field values at the breakdown points, the I/sub c/, B curve for the superconducting material can be derived. As a maximum, currents of 4000 A were induced in a coil made of superconducting cable. Inductive screening of a magnetic field by a superconducting coil is correlated with a negative field in the center. Author (NSA)

N76-24707# Kernforschungszentrum, Karlsruhe (West Germany).
PROBLEMS OF COOLING SUPERCONDUCTING SYNCHROGENERATORS
A. Hofmann Mar. 1975 8 p Transl. into ENGLISH from the German Presented at the Spring Meeting of the Solid-State Physicists of the DPG, Muenster, West Germany, 17-22, Mar. 1975
(ERDA-tr-82; Conf-750359-2) Avail: NTIS HC $4.50

The development of large turbogenerators with superconducting exciter winding has moved into the area of considerable economic interest. The advantages and problems of superconductance are discussed. The problems of cooling the cold rotor are especially considered in detail. At the same time, discussions concern what thermal losses are to be expected and what effects occur with respect to coolant flow, heat transmission as well as the change of state of cooiant in a rotating system as a result of centrifugal and Coriolis forces. A listing is made as to what formulations are available for solution of these problems and what investigations are to be carried out before a reliable design of a superconducting rotor can result. Author (NSA)

N76-24708# California Univ., Berkeley. Lawrence Berkeley Lab.
RADIOACTIVITY OF GEOTHERMAL SYSTEMS
H. A. Wollenberg May 1975 28 p refs Presented at the United Nations Symp. on the Develop. and Uses of Geothermal Resources, San Francisco
(Contract W-7405-eng-48)
(LBL-3232; Conf-750525) Avail: NTIS HC $4.50

An examination of hot spring waters in Nevada indicates the presence of radium-226 and radon-222, in varying abundances, in spring systems where CaCO3 is the predominant material being deposited. Systems where silica predominates are relatively low in radioactivity. At a hot spring site in north-central Nevada where CaCO3 predominates, gamma ray levels from 0.25 to 0.5 milliroentgens per hour were measured over an enclosed warm pool. At other systems where SiO2 predominates, gamma exposure rates are nearly two orders of magnitude lower. Results of studies combining neutron activation analyses of hot and cold waters in a region, and radiometric analyses of the waters and hot spring deposits, suggest that uranium entering a geothermal system is localized at depth by: (1) a reducing environment afforded by H2S; and (2) precipitation of uranyl carbonate. Author (ERA)

N76-24709# Los Alamos Scientific Lab., N.Mex.
GEOTHERMAL ENERGY
J. W. Tester and S. L. Milora 1975 18 p refs Presented at the Energy Sources of the Future Meeting, Oak Ridge, Tenn.
(Contract W-7405-eng-36)
(LA-UR-75-1463; Conf-750733-1) Avail: NTIS HC $4.00

Six areas of geothermal resource utilization are discussed: (1) concept and potential of the resource; (2) natural geothermal systems; (3) artificially stimulated, dry hot rock geothermal systems; (4) energy utilization alternatives; (5) power cycle thermodynamics; and (6) power cycle economics. A summary is also given of the preliminary results from a joint study directed toward developing thermodynamic and economic design criteria applicable to geothermal electric power systems. ERA

N76-24710# Aerojet Nuclear Co., Idaho Falls, Idaho. Idaho National Engineering Lab.
FEASIBILITY REVIEW FOR GEOTHERMAL CONVERSION OF EXISTING H AND V SYSTEMS ON THE BOISE GEOTHERMAL SPACE HEATING PROJECT
L. D. Torgerson and A. S. Richardson Sep. 1975 66 p
(Contract E(10-1)-1375)
(ANCR-1256) Avail: NTIS HC $5.45

A pilot demonstration project to be located in the city of Boise, Idaho has been initiated to heat by geothermal water a number of public buildings. This report presentes the findings of a study which was made to review the feasibility of converting the various public building heating systems to allow the use of geothermal water at a temperature of a least 170 F as a heat source. Author (ERA)

N76-24711# Danish Atomic Energy Commission, Risoe.
DYNAMICS AND CONTROL OF A SIMPLIFIED ONCE-THROUGH BOILER
M. Lind Mar. 1975 113 p refs
(RISO-M-1759) Avail: ERDA Depository Libraries HC $8.75

A dynamic point model of a simplified once-through boiler was developed. The model comprises economizer, evaporator, burner and feedwater pump dynamics. The reheater and superheaters are excluded, but the influence of the superheater volume on the pressure dynamics is included. The model is nonlinear and has six state variables. A linearized model valid for perturbations around an operating point was derived from the nonlinear model, and computer programs were developed for computation of statespace and transfer matrices in selected operating points. The properties of the linearized boiler model at full power conditions as a multivariable control object was studied. On the basis of these considerations some decoupling control systems are proposed and compared by frequency analytical methods and simulation on an analogue computer. Author (ERA)

N76-24712# Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
REVIEW OF PUMPED ENERGY STORAGE SCHEMES
G. N. Unsworth Jul. 1975 56 p refs
(AECL-4926) Avail: ERDA Depository Libraries HC $5.50; Atomic Energy of Can. Ltd., Chalk River HC $1.50

Pumped energy storage will become an attractive consideration for utilities as their installed nuclear generating capacity

increases to the point that it exceeds the minimum power demand. A summary is given of energy storage systems that are available and might prove economically attractive. The advantages and disadvantages of each scheme and a comparative cost study are presented. The energy storage schemes considered are: pumped water storage; steam accumulators; storage of boiler feedwater (in caverns and above ground); and compressed air in caverns (for gas turbines). The results of cost analysis indicate that boiler feedwater storage in caverns and pumped water storage are competitive as the most economical scheme.
Author (ERA)

N76-24713# Pennsylvania Dept. of Education, Harrisburg.
ENVIRONMENTAL IMPACT OF ELECTRICAL POWER GENERATION: NUCLEAR AND FOSSIL
1975 240 p refs
(Contract AT(40-2)-4167)
(ERDA-69) Avail: NTIS HC $8.00

The increasing need for electrical power, and current and proposed methods for meeting this need are examined. Expansion of electrical generating capacity in the immediate future will be limited to nuclear power plants or fossil fueled plants. Basic ecology and wastes from nuclear and fossil fueled plants are discussed. Health effects are analyzed. The factors that must be taken into consideration when choosing the site for a new power plant are presented. Energy conservation and a summary of environmental effects are included. Author (ERA)

N76-24714# Battelle Pacific Northwest Labs., Richland, Wash.
NUCLEAR OPTION
L. C. Schmid 1975 15 p refs Presented at the Bend in the River Conf., Bend, Oreg.
(Contract E(45-1)-1830)
(BNWL-SA-5525; Conf-750746-1) Avail: NTIS HC $4.50

The comparison of coal, oil, and nuclear energy as sources of electric power for the U.S. is presented. Economic and safety aspects are considered. ERA

N76-24715# Washington Univ., Seattle. Dept. of Physics.
ENERGY CONTROVERSY: THE ROLE OF NUCLEAR POWER
Fred H. Schmidt and D. Bogdanski Feb. 1975 101 p refs Sponsored in part by ERDA
(RLO-1388-296) Avail: NTIS HC $6.50

Only nuclear fission, nuclear fusion, and solar energy can provide for future time scales commensurate with man's historic past, while avoiding the possibility of catastrophic social upheaval. Fusion and solar energy are rejected on technological grounds because the world energy problem is so pressing that one cannot gamble on hopes for future technological breakthroughs. Thus, only nuclear fission meets the twin criteria of technological feasibility and adequate resource base. Each of the controversial issues surrounding nuclear fission energy is examined in some detail. The conclusion is reached that none is serious, and that nuclear fission offers by far the best energy source from environmental, economic, longevity, and overall safety standpoints. Author (ERA)

N76-24716# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorbauelemente.
THERMODYNAMIC CALCULATION OF A LONG-DISTANCE ENERGY CIRCUIT
B. Hoehlein, A. Bauer, G. Kraut, and F. D. Scherberich Aug. 1975 33 p refs In GERMAN
(JUL-1232) Avail: ERDA Depository Libraries HC $5.00

A calculational model is presented for the nuclear long distance energy circuit. Such a circuit means the combination of a steam reforming plant with heat supply from a high temperature nuclear reactor and a methanation plant with heat production for district heating or electricity production. The model comprises thermodynamic calculations for the endothermic methane reforming reaction as well as the exothermic CO hydrogenation in adiabatic reactors and allows the optimization of the long distance energy circuit under consideration.
Author (ERA)

N76-24717# Lockheed Missiles and Space Co., Sunnyvale, Calif.
OCEAN THERMAL ENERGY CONVERSION (OTEC) POWER PLANT TECHNICAL AND ECONOMIC FEASIBILITY. VOLUME 2: SUPPORTING DATA
12 Apr. 1975 818 p refs Sponsored in part by ERDA and NSF Prepared in cooperation with Bechtel Corp., San Francisco and Lin (T. Y.) International, San Francisco
(LMSC-D056566-Vol-2; NSF/RANN/SE/GI-C-937/FR-75-1-2) Avail: NTIS HC $21.25

A 9-month study of the practicality of generating electrical power at competitive busbar prices by using the solar energy that is stored as a thermal gradient in the world's oceans was completed. This volume is a compendium of the most significant detailed data and engineering analyses developed during the course of this brief, but intensive, study of a complex problem. ERA

N76-24718# Sandia Labs., Albuquerque, N.Mex.
BRIEF DESCRIPTION OF SOLSYS: ENERGY SYSTEM SIMULATION COMPUTER PROGRAM
Michael W. Edenburn and Norman R. Grandjean Sep. 1975 22 p refs Sponsored in part by NSF
(Contract AT(29-1)-789)
(SAND-75-0388) Avail: NTIS HC $4.00

Program (SOLSYS) is used primarily to simulate the transient performance of solar energy systems. The program consists of a component subroutine library, an information subroutine library, a control-component subroutine library, and an executive program. Component subroutines model the performance of fluid-handling components which can be connected to construct almost any desired energy system. The component subroutine library presently contains 21 subroutines modeling collectors, storage units, power-generation cycles, transmission and distribution hardware, heat exchangers, house equipment, and auxiliary energy components. Some components are modeled very accurately and others used simple energy-conservation models. Information subroutines supply time-dependent information such as insolation data, weather data, heating requirements, air-conditioning requirements, hot water requirements, and electrical requirements to the program. Author (ERA)

N76-24719# Argonne National Lab., Ill.
ANALYSIS OF A SYSTEM TO THERMALLY DISSOCIATE WATER USING A SEMIPERMEABLE MEMBRANE
N. C. Ford, Jr. Sep. 1975 23 p refs
(Contract W-31-109-eng-38)
(ANL-75-65) Avail: NTIS HC $4.00

A scheme using oxygen and hydrogen permeable membranes to thermally dissociate water into hydrogen and oxygen in order to provide for the storage and transportation of thermal energy is described and analyzed in terms of presently available materials. While the process is potentially very efficient, the membranes required to separate the hydrogen and oxygen are not stable at sufficiently high temperatures. It is concluded that a high temperature hydrogen permeable membrane must be discovered before further work is warranted. The rare earth-palladium compounds may have the desired characteristics.
Author (ERA)

N76-24720# California Univ., Berkeley. Lawrence Berkeley Lab.
STUDY OF THE ROTORFERMENTOR AND THE KINETICS OF ETHANOL FERMENTATION
A. Margaritis and C. R. Wilke Jul. 1975 338 p refs
(Contract W-7405-eng-48)
(LBL-3278) Avail: NTIS

A bench scale pilot plant was designed and built to test the feasibility of the Rotorfermentor as a device for potential use in the fermentation industry. The Rotorfermentor is a fermentation device designed to achieve high cell concentrations. This is achieved by filtration through a rotating microporous membrane enclosed inside the fermentor. The operational feasibility of the Rotorfermentor was demonstrated by carrying out transient growth ethanol fermentation experiments. Both the cell concentration and ethanol productivity per unit fermentor volume were found to be much higher than those for an ordinary C.S.T. fermentor. Basic ethanol fermentation kinetics studies on Saccharomyces cerevisiae ATCC No. 4126 were carried out in an ordinary C.S.T. fermentor. It was found that both oxygen and glucose concentration affect the production of cell mass

and ethanol as well as endogenous metabolism. At high glucose concentrations, increases in oxygen concentration produced very small effects while at low glucose concentrations the oxygen effect was maximal. Author (ERA)

N76-24721# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorfoschungsanlage und Heisse Zellen.

PYROLYSIS OF METHANE BY MICROWAVES, PART 1

R. Avni, J. S. Winefordner, and H. Nickel Apr. 1975 56 p refs

(JUL-1188-Pt-1) Avail: ERDA Depository Libraries HC $5.50

The pyrolysis of methane and mixtures of argon-methane by microwaves (2450 MHz) was investigated in the study of the mechanism of pyrocarbon formation. The microwave plasma diagnostic study was performed using electrical probes, namely, the double floating probe technique. Parameters such as electric field strength and current densities were measured and from their relationship the electron temperature, electric conductivity, and electron and ion densities were evaluated as function of gas pressure, microwave power input, and distance of the probe from the microwave cavity. Various spectroscopic techniques were used for the measurement of temperatures in the microwave plasma; the reversal temperature by measuring the intensities of the electronic vibrational bands of CN and OH molecules and rotational temperature from the measured intensities of rotational OH lines. The rotational as well as the reversal temperature were found to be identical and this temperature was assumed to be the temperature of the gas in the microwave plasma. Author (ERA)

N76-24722# Organization for Industrial Research, TNO, The Hague (Netherlands).

HYDROGEN AS ENERGY CARRIER. FUTURE POSSIBILITIES IN THE NETHERLANDS. A SUMMARY [TOEKOMSTIGE MOGELIJKHEDEN VAN WATERSTOF ALS ENERGIEDRAGER IN NEDERLAND. BEKNOPT OVERZICHT]

Sep. 1975 41 p In DUTCH

Avail: NTIS HC $4.00

The application of hydrogen as carrier for thermal energy, as discussed in the full report is summarized, with emphasis on production, storage, transport, and distribution of hydrogen, location bound utilization, application in transport vehicles, environment, and safety. ESA

N76-24723# Organization for Industrial Research, TNO, The Hague (Netherlands).

HYDROGEN AS ENERGY CARRIER. FUTURE POSSIBILITIES IN THE NETHERLANDS [WATERSTOF ALS ENERGIEDRAGER, TOEKOMSTIGE MOGELIJKHEDEN IN NEDERLAND]

Sep. 1975 281 p refs In DUTCH

Avail: NTIS HC $9.25

The application of hydrogen as carrier for thermal energy, produced by new energy sources such as nuclear reactors and wind and solar energy generators, is discussed. Topics dealt with include production, storage, transport and distribution of hydrogen, aspects of location bound use, application in transport vehicles, environmental and safety aspects, and problems in introducing hydrogen. Conclusions and recommendations for each of these topics are given and, as a general conclusion, there are thought to be wide perspectives for the use of hydrogen as carrier in the energy supply in the Netherlands. The technological problems are considered surmountable. ESA

N76-24724# Staatliches Forschungsinstitut fuer Geochemie, Bamberg (West Germany).

INVESTIGATION OF ACID-RESISTANT ELECTROCATALYSTS FOR FUEL CELLS [UNTERSUCHUNGEN UEBER SAEURERESISTENTE ELEKTROKATALYSATOREN FUER BRENNSTOFFZELLEN]

H. U. Meier, U. Tschirwitz, E. Zimmerhackl, and W. Albrecht Bonn DOKZENTBw 1975 104 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-75-6) Avail: NTIS HC $5.50; DOKZENTBw DM 30.00

Methods used in the synthesis of electrocatalysts belonging to the class of polymeric metal-phthalocyanines and the procedure of testing electrocatalytic properties of these polymers are reported. Various properties of polymeric phthalocyanines (such as conductivity, catalase effect, and stability in acid) and the electrocatalytic activity for the reduction of oxygen obtained in sulfuric acid are described. A high catalytic activity with respect to the oxygen reduction was obtained in 6 n H_2SO_4 with carbon-Teflon electrodes containing polymeric iron-phthalocyanine compounds. The current density was 20 to 80 mA/sq cm for a potential of 850 to 650 mV (standard hydrogen electrode) at room temperature. The potentials of the electrodes with polymeric phthalocyanine complexes of iron (and cobalt) as catalysts show only a relatively small decrease with time which is in the order of less than 100 mV at a load of 20 mA/sq cm during 1,000 hr. The high electrocatalytic activity of Fe-polyphthalocyanines is explained using a model. Author (ESA)

N76-24725# Institut Franco-Allemand de Recherches, St. Louis (France).

APPLICATION OF PHASE TRANSITIONS TO MECHANO-ELECTRICAL ENERGY CONVERSION [ANWENDUNG DER PHASENUEBERGAENGE AUF DIE MECHANISCH-ELEKTRISCHE ENERGIEUMWANDLUNG]

F. Bauer, K. Vollrath, Y. Fetiveau (Lab. de Ferroelec., Lyon), and L. Eyraud (Lab. de Ferroelec., Lyon) 7 Jan. 1975 14 p refs In GERMAN Presented at the German Phys. Soc. Congr. (DPG), Nuremberg, 24 Sep. 1974

(ISL-CO-201/75) Avail: NTIS HC $3.50

Ferroelectric ceramics of the type $Pb(Zr(1-x)Ti(x))O3$ were investigated with respect to changes from the ferroelectric state to the antiferroelectric state depolarization under hydrostatic pressure and shock loads, and the electric charge set free by these changes. It is shown that these ceramics with high zirconium contents have the property of producing twice the electrical energy recuperable during mechano-electrical irreversible energy conversion as compared to classical piezoelectric ceramics. ESA

N76-24726# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.

PRODUCTION AND UTILIZATION OF ALTERNATIVE SECONDARY ENERGY CARRIERS [ERZEUGUNG UND NUTZBARMACHUNG VON ALTERNATIVEN SEKUNDAER-ENERGIETRAEGERN]

J. Nitsch 24 Apr. 1975 34 p In GERMAN

(DLR-IB-456-75/5) Avail: NTIS HC $4.00

Planned projects are outlined. Hydrogen, the most promising and most universal energy carriers, is used as an example. Primary activities considered are: investigation of combined thermochemical-electrolytical cycling processes, storage of hydrogen in low temperature absorbers and hydrogen-oxygen fed cycling process for energy storage and peak current generation. Supplementary activities are: the hydrogen aircraft, investigations of the liquid hydrogen tank/engine in an automobile, and safety investigations with hydrogen. Planned research in the fields of alcohols and mineral oil processing is mentioned. ESA

N76-24727# Delaware Univ., Newark. Inst. of Energy Conversion.

THE INFLUENCE OF AIR HEAT TREATMENTS ON CuxS SHEET RESISTANCE AND CdS-CuxS SOLAR CELL PERFORMANCE

L. C. Burton and V. Ricca Nov. 1975 18 p refs

(Grant NSF AER-72-03478-A04)

(PB-248853/4; NSF/RA/N-75-206) Avail: NTIS HC $3.50 CSCL 10B

Changes in the electrical sheet resistance of Cu(x)S and in the photovoltaic response of CdS-Cu(x)S cells have been measured as functions of thermal aging in air at 250C. It was found that sheet resistance (or bulk resistivity) initially increases and then decreases with aging. Maximum Cu(x)S bulk resistivity values were found to be about 0.1 ohm-cm. Cell electrical parameters were monitored with air heat treatments, degradation being accompanied by a decrease in Cu(x)S sheet resistance. The rates of change of Cu(x)S sheet resistance and cell light response with time in air at 250C are apparently enhanced by cell surface roughness. Some possible mechanisms are presented to account for observed behavior. GRA

N76-24728# Westinghouse Research Labs., Pittsburgh, Pa.
THIN FILM SOLAR CELLS FOR TERRESTRIAL APPLICATIONS Quarterly Progress Report, 1 Jul. - 30 Sep. 1975
F. A. Shirland, W. J. Biter, E. W. Greeneich, A. J. Simon, and T. P. Brody 24 Oct. 1975 76 p refs
(Grant NSF AER-74-14918-A01)
(PB-248817/9; NSF/RA/N-75-211; NSF/RANN/SE/A01/PR-75-3; QPR-1) Avail: NTIS HC $5.00 CSCL 10B

Steady improvements have been effected in the control of cell processing. This has resulted in improved understanding of the cell construction and in higher shunt resistances. These in combination with improved handling have enabled evaporated fine mesh grids to be deposited without the cell shorting experienced earlier. Encouraging results have been obtained with integral dielectric coverings for cell encapsulation. Both rf sputtered Si3N4, and evaporated SiO plus rf sputtered glass overlayers are showing promise. Encapsulated CdS thin film solar cells on both real time roof top exposure and accelerated life time exposure continue to show no difficulties after 9 months of testing. GRA

N76-24729# Mitre Corp., McLean, Va.
PROCEEDINGS OF QUANTITATIVE ENVIRONMENTAL COMPARISON OF COAL AND NUCLEAR ELECTRICAL GENERATION AND THEIR ASSOCIATED FUEL CYCLES WORKSHOP, VOLUME 1
Aug. 1975 357 p refs Workshop held in McLean, Va., 27-28 May 1975 2 Vol.
(Contract NSF C-925)
(PB-248649/6; MTR-7010-Vol-1; NSF/OEP-76-0001-Vol-1) Avail: NTIS HC $10.50 HC also available from NTIS $21.00/set of 3 reports as PB-221906-SET CSCL 10B

A partial listing of topic areas includes: Application of decision analysis methodology to coal and nuclear fuel cycles; Social costs and risk of nuclear radiation accident; Social and economic costs of the nuclear and coal fuel cycles; Fossil fuel utilization, pollution, and climate modification risk; Diversion and sabotage; Issues concerning the safety and safeguards in the transportation of radioactive materials; Release mechanisms of fuel reprocessing plants; A risk comparison of recovery vs. reactor plants; The nature of nuclear wastes and the question of time perspectives. GRA

N76-24730# Mitre Corp., McLean, Va.
PROCEEDINGS OF QUANTITATIVE ENVIRONMENTAL COMPARISON OF COAL AND NUCLEAR ELECTRICAL GENERATION AND THEIR ASSOCIATED FUEL CYCLES WORKSHOP, VOLUME 2
Aug. 1975 207 p refs Workshop held in McLean, Va., 27-28 May 1975 2 Vol.
(Contract NSF C-925)
(PB-248650/4; MTR-7010-Vol-2; NSF/OEP-76-0002-Vol-2) Avail: NTIS HC $7.75 HC also available from NTIS $21.00/set of 3 reports as PB-248648-SET CSCL 10B

This report contains the second day's edited transcripts of discussions and comments at a workshop on the Quantitative Environmental Comparison of Coal and Nuclear Electric Generation and Their Associated Fuel Cycles held at The MITRE Corporation in McLean, Virginia on May 27 and 28, 1975. The purpose of the workshop was to quantify the risks arising from the various elements of coal and nuclear fuel cycles and to assess the economic costs and environmental consequences associated with electric generation. GRA

N76-24731# Mitre Corp., McLean, Va.
QUANTITATIVE ENVIRONMENTAL COMPARISON OF COAL AND NUCLEAR GENERATION WORKSHOP, SUMMARY
R. Bernardi and B. Borko Sep. 1975 98 p refs Workshop held at McLean, Va., 27-28 May 1975 2 Vol.
(Contract NSF C-925)
(PB-248651/2; MTR-7004-Suppl; NSF/OEP-76-0003-Suppl) Avail: NTIS HC $5.00 HC also available from NTIS $21.00/set of 3 reports as PB-248648-SET CSCL 10B

On May 27 and 28, 1975, The MITRE Corporation held a workshop addressing the quantitative environmental comparison of coal and nuclear electrical generation. The agenda was planned to summarize the risks arising from the various elements of the coal and nuclear fuel cycles and to assess the economic and environmental consequences associated with electrical generation. This document summarizes the presentations, comments, and discussions at the workshop. GRA

N76-24732# Nuclear Regulatory Commission, Washington, D.C. Office of Special Studies.
NUCLEAR ENERGY CENTER SITE SURVEY, 1975. PART 1. SUMMARY AND CONCLUSIONS
Jan. 1976 231 p
(PB-248612/4; NUREG-0001-Pt-1) Avail: NTIS HC $8.00 Also available in set of 7 reports as PB-248610-SET. HC $59.00 CSCL 18E

Clustering of sizable groups of nuclear facilities on a relatively small number of sites is examined. Three basic types of nuclear energy centers (NECs) are considered: power-plant centers (10 to 40 nuclear electric generating units of 1,200-MWe capacity each); fuel-cycle centers (fuel reprocessing plants, mixed-oxide fuel fabrication facilities, and radioactive waste management facilities); and combined (power and fuel-cycle) centers. The survey evaluates the feasibility and practicality of the NEC concept. The technical feasibility considerations include dissipation of waste heat, transmission, construction economics, and radiological and environmental impacts. GRA

N76-24733# Nuclear Regulatory Commission, Washington, D.C. Office of Special Studies.
NUCLEAR ENERGY CENTER SITE SURVEY, 1975. PART 2. THE US ELECTRIC POWER SYSTEM AND THE POTENTIAL ROLE OF NUCLEAR ENERGY CENTERS
Jan. 1976 231 p refs
(PB-248613/2; NUREG-0001-Pt-2) Avail: NTIS HC $8.00 Also available in set of 7 reports as PB-248610-SET. HC $59.00 CSCL 18E

A perspective of the U.S. electric power system and the potential role of nuclear energy centers in the future evolution of the system are considered. GRA

N76-24734# Nuclear Regulatory Commission, Washington, D.C. Office of Special Studies.
NUCLEAR ENERGY CENTER SITE SURVEY, 1975. PART 3. TECHNICAL CONSIDERATIONS
Jan. 1976 635 p refs
(PB-248614/0; NUREG-0001-Pt-3) Avail: NTIS HC $16.25 Also available in set of 7 reports as PB-248610-SET. HC $59.00 CSCL 18E

The technical considerations involved in determining whether or not the nuclear energy center concept is feasible are analyzed. Principal issues included are heat dissipation to the atmosphere, electric power transmission, facility and transmission unit costs, and radiological and environmental impact. GRA

N76-24735# Nuclear Regulatory Commission, Washington, D.C. Office of Special Studies.
NUCLEAR ENERGY CENTER SITE SURVEY, 1975. PART 4. PRACTICAL ISSUES OF IMPLEMENTATION
Jan. 1976 709 p
(PB-248615/7; NUREG-0001-Pt-4) Avail: NTIS HC $18.75 Also available in set of 7 reports as PB-248610-SET. HC $59.00 CSCL 18E

The practical issues involved in analyzing whether or not the nuclear energy center concept should be implemented are explored. These include jurisdictional, institutional, and economic considerations; social, socioeconomic, and sociopolitical impacts; and accident risk, national disasters, national security, and nuclear materials safeguards implications. GRA

N76-24736# Nuclear Regulatory Commission, Washington, D.C. Office of Special Studies.
NUCLEAR ENERGY CENTER SITE SURVEY, 1975. EXECUTIVE SUMMARY
Jan. 1976 30 p
(PB-248611/6; NUREG-0001-ES) Avail: NTIS HC $4.00 Also available in set of 7 reports as PB-248610-SET. HC $59.00 CSCL 18E

For abstract, see N76-24732.

N76-24737# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Energy Conversion Branch.
FABRICATION AND INVESTIGATION OF NICKEL-ALKALINE CELLS. PART 1: FABRICATION OF NICKEL-HYDROXIDE ELECTRODES USING ELECTROCHEMICAL IMPREGNATION TECHNIQUES Interim Report, 1 Jan. 1971 - Jan. 1974
David F. Pickett Oct. 1975 77 p refs
(AF Proj. 3145)
(AD-A018517; AFAPL-TR-75-34-Pt-1) Avail: NTIS CSCL 10/3

Several electrochemical impregnation techniques for deposition of active Nickel-Hydroxide inside nickel sinters have been investigated. The most favorable means of impregnation appears to be deposition from alcoholic nitrate solutions. Formation cycling of electrodes made from the various techniques has been performed using 20-50% overcharge for 10-30 cycles. Some electrodes show capacities as high as 9.5 ampere-hours per cubic inch after these cycles. The alcohol process has been scaled to pilot production, and several 20-25 A-H vented Nickel-Cadmium cells were constructed using cadmium electrodes fabricated from another electrochemical technique. These cells show vastly improved charge acceptance, at a wide temperature range, over state-of-the-art vented aircraft cells and improved cycle life at high temperatures and deep depths of discharge. GRA

N76-24738# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Energy Conversion Branch.
FABRICATION AND INVESTIGATION OF NICKEL-ALKALINE CELLS. PART 2: ANALYSIS OF ETHANOLIC METAL NITRATE SOLUTIONS USED IN FABRICATION OF NICKEL HYDROXIDE ELECTRODES Interim Report, Jun. 1972 - Jan. 1975
David F. Pickett Oct. 1975 20 p refs
(AD-A018478; AFAPL-TR-75-34-Pt-2) Avail: NTIS CSCL 10/3

Ethanol solutions containing nickel and cobalt nitrates are used in a recently developed process for electrodeposition of nickel and cobalt hydroxides inside nickel sinters (D.F. Pickett, U.S. Patent 3,827,911 (1974)). Nickel hydroxide electrodes, resulting from this technique, have demonstrated superior performance over electrodes commonly used in aerospace Ni-Cd batteries (V. J. Puglisi, H. N. Seiger, and D. F. Pickett, Proceedings of the 9th IECEC Conference San Francisco, CA, Aug 1974, pp. 873-879). In order to control quality of these new electrodes several methods of analysis for impregnating solutions have been developed. These methods employ use of techniques such as gas chromatography, atomic absorption spectrophotometry, and visual spectrophotometry for individual component analysis. GRA

N76-24739# Air Force Civil Engineering Center, Tyndall AFB, Fla.
OPTIMIZATION OF ENERGY USAGE IN MILITARY FACILITIES (PHASE 1) Interim Report, Nov. 1974 - Jul. 1975
D. Hittle and D. Herron Oct. 1975 47 p refs
(AD-A019107; AFCEC-TR-75-22) Avail: NTIS CSCL 13/1

A computer model was developed for predicting hourly building thermal loads and simulating the response of heating and cooling systems to these hourly loads. The rigorous algorithms employed in the program permit determination of the effects of building and system design variables on energy consumption. The report presents results of the program application to a test case building at four sites. GRA

N76-24740# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STAND FOR INVESTIGATING MODELS OF ELECTROGASDYNAMIC ENERGY CONVERTERS
V. I. Orlando 9 Dec. 1975 13 p refs Transl. into ENGLISH from Kievsk. Inst. Grazhdanskogoi Aviat., Sb. Nauchn. Tr. (USSR), no. 7, 1971 p 34-38
(AD-A019168; FTD-ID(RS)I-2426-75) Avail: NTIS CSCL 10/2

A general purpose experimental bench with an electrogasdynamic generator was designed and made. The bench can operate with various sources of charged particles. Preliminary experimental data obtained during tests are summarized. J.M.S.

N76-24741# EIC, Inc., Newton, Mass.
LITHIUM-INORGANIC ELECTROLYTE BATTERIES Quarterly Report, 16 Mar. - 15 Jun. 1975
Joseph R. Driscoll, Gerhard L. Holleck, and David E. Toland Nov. 1975 30 p refs
(Contract DAAB07-74-C-0030; DA Proj. 1T1-61102-A-34A)
(AD-A018705; C-401-7; ECOM-74-0030-7; QR-7) Avail: NTIS CSCL 10/3

An all-inorganic electrolyte, lithium primary battery operable over the temperature range -40 to +160F is being evaluated. The desired energy density is 150 watt-hours per pound of total battery weight and the desired power density is 50 watts per pound. The present report contains data regarding the film formation after storage at 71C and initial experiments towards the determination of the charge equivalent involved in the reduction of SOCl2. Li/SOCl2 cells show large voltage delays due to Li electrode polarization after storage for 4 to 9 days at 71C under high purity conditions. Fresh Li electrodes can support large anodic current densities = 200 mA/sq cm. Stored electrodes showed low currents approximately 0.3 mA/sq cm which are practically independent of electrode polarization between 0.5 and 3.0 V vs. Li. Electrolyte additives or substitution of Li by a Li/Sn alloy did not significantly alter the voltage delay behavior. GRA

N76-24742# Radian Corp., Austin, Tex.
STATE OF CHARGE DETERMINATION FOR AEROSPACE BATTERIES Final Report, Oct. 1973 - Aug. 1975
David C. Jones, David W. DeBerry, and William Shelton Clark Oct. 1975 122 p ref
(Contract F33615-74-C-2005; AF Proj. 3143)
(AD-A019480; AFAPL-TR-75-83) Avail: NTIS CSCL 10/3

High current, short duration pulses were investigated as methods for determining the state-of-charge of nickel-cadmium and zinc-silver oxide batteries. An accurate indicator over the whole state-of-charge range for nickel-cadmium batteries was developed on the basis of a constant voltage discharge pulse and a preconditioning step. The effects of temperature, cycling, and cell variations on test results were determined. The procedure was shown to be able to test cells of unknown background and to detect the presence of weak or defective cells. A constant voltage discharge pulse test was developed to determine if a zinc-silver oxide battery was charged above 80-85% of full capacity. GRA

N76-24743# Pennsylvania Univ., Philadelphia. Dept. of Chemical and Biochemical Engineering.
LITHIUM SULFURYL CHLORIDE BATTERY Semiannual Report, 1 Dec. 1974 - 31 May 1975
Leonard Nanis, Vijay K. Kapur, Mao-Yao Huang, and Mehmet Ali Gencer Oct. 1975 33 p refs
(Contract DAAB07-75-C-1676; DA Proj. 1S7-62705-AH-94)
(AD-A018852; ECOM-75-1676-1) Avail: NTIS CSCL 10/3

LiAlCl4 in SO2Cl2 was used as the electrolyte in a battery with a lithium metal anode and a carbon cathode. A preliminary conductivity value for LiAlCl4 (2.5M) in SO2Cl2 at 25C was found to be 5 plus or minus 2 X 10 to the -3 power Ohm/cm. A simple four point probe conductivity measurement method has been devised in order to avoid frequency dependent impedance behavior at electrodes and to improve the precision of conductance measurement. Discharge characteristics of the cell Li/LiAlCl4(2.5M)-SO2Cl2/C were studied. Open circuit voltage of 3.96V was obtained. Accumulation of reduction products on the carbon cathode decreased the life of the cell. Replacement of the cathode renewed cell activity. GRA

N76-24744# Stanford Univ., Calif. Inst. for Energy Studies.
REPORT OF THE NSF-STANFORD WORKSHOP ON NET ENERGY ANALYSIS Final Report
T. J. Connolly and J. R. Spraul Dec. 1975 219 p refs Workshop held at Stanford, Calif., 25-28 Aug. 1975 Prepared jointly with TRW Systems Group, Redondo Beach, Calif.
(Grant NSF GI-27976)
(PB-248603/3; TRW-27976-6001-RU-000) Avail: NTIS HC $7.75 CSCL 10A

This workshop was convened to afford an opportunity for extended discussions on details of methodology and application of net energy analysis. The participants were divided into six

small working groups. Their verbatim reports are included along with presentations made by recognized authorities on process, input-output and energetic methodology for net energy analysis. Initially the groups addressed methodological questions relating to net energy analysis such as appropriate measures of net energy, systems boundaries, intertemporal aspects, details of indirect energy calculations and preferred thermodynamic properties. Questions of a policy nature were then addressed. There was strong agreement that net energy analysis is best considered as a companion to economic, environmental and other analyses that might be appropriate to the question at hand. Other possible policy applications suggested for net energy analysis included evaluations of resource depletion, energy conservation options, energy content of foreign trade and energy impact of various laws and regulations. GRA

N76-24745# Schleif (Ferber R.), Denver, Colo.
COMPUTERIZATION AND ELECTRIC POWER
Ferber R. Schleif Nov. 1975 31 p refs
(PB-249002/7; EPRI-SR-21) Avail: NTIS HC $4.00 CSCL 13B

The state of the art is reviewed of computerization in the electric power industry. Progress of computerization in this field is considered in light of the utility nature of the electric power industry. The review approaches the subject from the systems aspect, progressing secondarily to individual functions. The principal focus is on the minicomputer and small embodiments of digital technology; and as these are often used as components in larger systems, some treatment of the larger systems is included. As applications for electric instrumentation, data acquisition, and control are numerous and diverse, an illustrative example in each of several categories is described. GRA

N76-24746# Combustion Engineering, Inc., Windsor, Conn.
ASSESSMENT OF THE CAPABILITY OF FIRING CLEAN LOW BTU GASES IN EXISTING COAL, OIL AND GAS-FIRED STEAM GENERATORS Final Report
Dec. 1975 95 p refs Sponsored by Elec. Power Res. Inst.
(PB-248328/7; EPRI-265-1) Avail: NTIS HC $5.00 CSCL 10B

The objective of this study is to assess the capability of existing steam generating units in electric utility plants when firing low BTU gas (LBG). This includes: (1) determining the maximum generating capacity without making any modifications to existing pressure parts or auxiliary components; (2) establishing the minimum heating value of LBG that can be used to obtain original maximum continuous rating; (3) defining the alternations and estimating the order of magnitude costs which are required to achieve original maximum continuous rating; (4) providing performance data to make a comparative evaluation of LBG firing. This report includes an evaluation of five low BTU gases with higher heating values of 105 BTU/SCF, 128 BTU/SCF, 179 BTU/SCF, 292 BTU/SCF, and 396 BTU/SCF. Six typical modern type steam generating units were randomly selected for study. GRA

N76-24747# TRW Systems Group, Redondo Beach, Calif.
DEVELOPMENT PROGRAM FOR SOLID ELECTROLYTE BATTERIES Interim Report
Herbert P. Silverman Dec. 1975 88 p Sponsored by Electric Power Res. Inst.
(PB-248326/1; EPRI-127-2) Avail: NTIS HC $5.00 CSCL 10C

The long term requirements of the battery system directed towards the engineering and production aspects of large battery systems are stressed. Emphasis is placed on simple cell geometries that are consistent with requirements of load-leveling battery systems and on solid electrolytes that process in the appropriate balance of conductivity, strength, cost, and lifetime. GRA

N76-24748# New York State Energy Research and Development Authority, New York.
ENVIRONMENTAL ASSESSMENT OF POWER PLANT SPRAY COOLING SYSTEMS. EXPERIMENTAL PROGRAM TO EVALUATE AND MINIMIZE THE ENVIRONMENTAL EFFECTS OF SPRAY MODULE COOLING SYSTEMS FOR THE STATE OF NEW YORK
Dec. 1975 158 p refs Prepared by Equitable Environmental Health, Inc.
(PB-248397/2; NYSERDA-75/11) Avail: NTIS HC $6.75 CSCL 13B

The report presents the conclusions and recommendations for an experimental program to evaluate and minimize the environmental effects of spray module cooling systems for the state of New York. It is recommended that an environmental performance test be conducted at the Authority's spray module facility using commercially available state-of-the-art spray modules from different manufactures. The thermal performance as well as the environmental effects of each module would be quantified. Upon completion of the initial testing, experiments will be designed to determine methods that will reduce drift, icing and fogging due to the operation of spray modules. Scavenging and other techniques to reduce the environmental impacts of spray module operation will be investigated. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-24749*# Old Dominion Univ., Norfolk, Va. Dept. of Physics and Geophysical Sciences.
PLYMOUTH PARK, CHESAPEAKE, VIRGINIA AIR QUALITY EXPERIMENT, 20 JUNE - 11 JULY 1975
G. E. Copeland Sep. 1975 168 p
(Grant NGL-47-003-067)
(NASA-CR-147987; PGS-TR-AP-75-11) Avail: NTIS HC $6.75 CSCL 13B

A detailed field study of the various air pollutants in the South Norfolk section of the City of Chesapeake during the last half of June and the first half of July 1975 is presented and the calibration and processing procedures are reported. Author

N76-24750*# Old Dominion Univ., Norfolk, Va. Dept. of Physics and Geophysical Sciences.
SOFTWARE FOR DIGITAL ACQUISITION SYSTEM AND APPLICATION TO ENVIRONMENTAL MONITORING
G. E. Copeland Nov. 1975 47 p refs
(Grant NGL-47-003-067)
(NASA-CR-147986; PGS-TR-AP-75-15) Avail: NTIS HC $4.00 CSCL 13B

Criteria for selection of a minicomputer for use as a core resident acquisition system were developed for the ODU Mobile Air Pollution Laboratory. A comprehensive data acquisition program named MONARCH was instituted in a DEC-8/E-8K 12-bit computer. Up to 32 analog voltage inputs are scanned sequentially, converted to BCD, and then to actual numbers. As many as 16 external devices (valves or any other two-state device) are controlled independently. MONARCH is written as a foreground-background program, controlled by an external clock which interrupts once per minute. Transducer voltages are averaged over user specified time intervals and, upon completion of any desired time sequence, outputted are: day, hour, minute, second; state of external valves; average value of each analogue voltage (E Format); as well as standard deviations of these values. Output is compatible with any serially addressed media. Author

N76-24751*# Environmental Research Inst. of Michigan, Ann Arbor.
SPECTRAL REFLECTANCE AND RADIANCE CHARACTERISTICS OF WATER POLLUTANTS Final Report, Sep. 1974 - Jun. 1975
C. T. Wezernak, R. E. Turner, and D. R. Lyzenga Washington NASA Apr. 1976 230 p refs
(Contract NAS1-13589)
(NASA-CR-2665; Rept-112000-9-F) Avail: NTIS HC $8.00 CSCL 13B

Spectral reflectance characteristics of water pollutants and water bodies were compiled using the existing literature. Radiance calculations were performed at satellite altitude for selected illumination angles and atmospheric conditions. The work described in this report was limited to the reflective portion of

the spectrum between 0.40 micrometer to 1.0 micrometer.
Author

N76-24752# Baird-Atomic, Inc., Bedford, Mass.
OPTIMIZATION AND EVALUATION OF A FLUORESCENCE OIL SPILL DETECTOR. VOLUME 1: LABORATORY MEASUREMENTS AND FIELD EVALUATION Final Report, Dec. 1974 - May 1975
William A. Webb and Herman G. Eldering May 1975 108 p refs
(Contract DOT-CG-43845-A; CG Proj. 7542.4.1)
(AD-A016460; USCG-D-108-75-Vol-1; Rept-5/75-6233-Vol-1)
Avail: NTIS CSCL 07/4

The work described in this report was directed at maximizing the detection range of an automatic fluorescence oil spill detector and evaluating the detection capabilities of this detector against a wide range of petroleum oils. On the basis of this evaluation, a Scanning Oil Spill detector was designed. Corrected fluorescence spectra of 22 petroleum oils at several film thicknesses are presented, and fluorescence spectral distribution and intensity of these oils are compared. A detection algorithm which discriminates oil from marine fluorescence on the basis of fluorescence measurements in two spectral regions is described. Laboratory and field tests demonstrated that oil fluorescence may be automatically and consistently discriminated from marine fluorescence. GRA

N76-24753# California Univ., Livermore. Lawrence Livermore Lab.
RESPONSE TO SUBCOMMITTEE ON ENVIRONMENT AND ATMOSPHERE
M. C. MacCracken Oct. 1975 11 p
(Contract W-7405-eng-48)
(UCID-16927) Avail: NTIS HC $4.50

The potential effects of chronic release of pollutants on climatic changes are discussed with regard to dose-response characteristics, ambiguities in prediction of climatic effects, ambiguities in measuring climatic effects, research approaches, and approaches to standard setting. A table is presented to show potential atmospheric effects of the following pollutants: CO2 from fossil fuels, fluorocarbons, nitrogen oxides, Kr-85 from nuclear power plants, sulfur compounds, dusts, heat and water releases from energy generation processes, and oceanic oil slicks. ERA

N76-24754# Energy Research and Development Administration, Bartlesville, Okla.
EMISSION CONTROL FOR DIESELS OPERATED UNDERGROUND, CATALYTIC CONVERTERS
W. F. Marshall Aug. 1975 12 p
(BERC/RI-75/8) Avail: NTIS HC $4.00

The Energy Research and Development Administration is conducting a series of experiments for the U.S. Bureau of Mines to determine the influences of emission controls on exhaust emissions from diesel engines. Tests were conducted with engines typical of those used in underground mines using catalysts specifically designed for diesel engines. Results showed marked differences in catalyst efficiencies for reducing carbon monoxide, hydrocarbon, and odor levels. Although catalysts decrease emissions of oxidizable toxicants, they can produce unwanted or hazardous products (for example, SO3). Subsequent exhaust treatment may be necessary for a complete control system.
Author (ERA)

N76-24755# Kiel Univ. (West Germany). Inst. fuer Meereskunde.
MICROBIOLOGICAL INVESTIGATIONS ON WATER POLLUTION CAUSED BY SEWAGE Final Report [MIKROBIOLOGISCHE UNTERSUCHUNGEN UEBER DIE WASSERVERSCHMUTZUNG DURCH ABWASSER]
Hans-Georg Hoppe, Klaus Gocke, and Gerhard Rheinheimer Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 25 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-75-04) Avail: NTIS HC $3.50; ZLDI, Munich DM 5,25

The investigations described concern the effect of sewage on marine bacteria and the relation of sewage-bacteria to marine conditions. Alterations in the substrate uptake of bacteria caused by pollution can be measured by the tracer technique. while corresponding changes of the population can be detected by autoradiography. The self-purification of Baltic and fresh water. with and without the influence of the addition of poisonous substances, was simulated in agitated batch-cultures.
Author (ESA)

N76-24756# Kiel Univ. (West Germany). Inst. fuer Meereskunde.
EXCHANGE INVESTIGATIONS IN THE KIEL BIGHT Final Report [AUSTAUSCHUNTERSUCHUNGEN IN DER KIELER BUCHT]
Lutz Martin Hubrich and F. Schott Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 25 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-75-05) Avail: NTIS HC $3.50; ZLDI, Munich DM 5,25

Experimental investigations were carried out in the Kiel Bight. part of the Western Baltic, to determine heat exchange and mixing parameters and their dependence on meteorological and oceanographic factors. Dye mixing experiments, the development of a combined aircraft-ship measuring method, and experimental results with low wind velocities and low current velocities are reported. An estimation of the local heat load in the inner Kiel Fjord from the cooling water of a water plant is given based on measured horizontal temperature distributions. Author (ESA)

N76-24757# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.
MEASUREMENT OF WATER SURFACE INFRARED RADIATION TEMPERATURE ALONG THE ITALIAN ADRIATIC COAST USING VHRR SATELLITE DATA [MESSUNG DER INFRAROTSTRAHLUNGSTEMPERATUR DER WASSEROBERFLAECHE IM KUESTENVERLAUF DER ITALIENISCHEN ADRIA MITTELS VHRR-SATELLITENDATEN]
Heinz Kaminski Mar. 1975 16 p refs In GERMAN; ENGLISH summary Presented at the 22nd Rass. Intern. Elettronica Nucl. ed Aerospaziale, Rome, Mar. 1975
Avail: NTIS HC $3.50

A zone with a distinct temperature gradient in the area of the Italian Adriatic coast was found from the data of the environmental earth research satellites NOAA 2, 3, and 4. This coastal zone obviously depends on the submarine topography. difference in density of the water masses, constant wind streams. influence of the tides, and inflows from the Alps and the Apennines. The zone can be monitored permanently the whole year long and it shows distinct maximum in the winter half-year. Therefore the mixing with the free Adriatic water is obviously very much limited, so that load factors resulting from industrial sites and urbanizations are to be taken into consideration concerning their quantity for this small constant transport zone in the coastal area in immediate front of the Italian Adriatic. The results of environmental earth research satellites make it possible to carry out large area plannings and large area supervisions. The present result is part of a voluminous study describing the supervision of the European waters and the atmosphere. The overlapping study is in the hands of the European Council. ESA

N76-24758# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.
REMOTE SENSING OF SEA CURRENTS, THEIR AREAL DISTRIBUTION AS WELL AS THEIR ECOLOGICAL IMPORTANCE FOR THE ITALIAN ADRIATIQUE COAST, BASED UPON INFRARED SATELLITE DATES (NOAA-VHRR)
Heinz Kaminski 1975 19 p refs In GERMAN; ENGLISH summary Presented at the Symp. of the Foederation Europaeischer Gewaesserschutz, Venice, 22-24 Oct. 1975
Avail: NTIS HC $3.50

A zone with a distinct temperature gradient in the area of the Italian Adriatic coast was found from the data of the environmental earth research satellites NOAA 2, 3 and 4. This coastal zone obviously depends on the submarine topography. difference in density of the water masses, constant wind streams, influence of the tides, and inflows from the Alps and the Apennines. The zone can be monitored permanently the whole year long and it shows a distinct maximum in the winter half-year. Therefore the mixing with the free Adriatic water is obviously

very much limited, so that load factors resulting from industrial sites and urbanizations are to be taken into consideration concerning their quantity for this small constant transport zone in the coastal area in immediate front of the Italian Adriatic. The results of environmental earth research satellites make it possible to carry out large area plannings and large area supervisions. The present result is part of a voluminous study describing the supervision of the European waters and the atmosphere. The overlapping study is in the hands of the European Council. Author (ESA)

N76-24759# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.
STUDY OF A EUROPEAN AIR AND WATER POLLUTION MONITORING SYSTEM USING ENVIRONMENTAL AND GEOPHYSICAL SATELLITES [STUDIE FUER EIN EUROPAEISCHES UEBERWACHUNGSSYSTEM ZUR BESTIMMUNG DER LUFT- UND WASSERVERSCHMUTZUNG MITTELS UMWELTUND ERDFORSCHUNGSSATELLITEN]
Heinz Kaminski 1974 64 p refs In GERMAN; ENGLISH summary Presented at the Symp. of the Foederation Europaeischer Gewaesserschutz, Strasbourg, 23-25 Oct. 1974
Avail: NTIS HC $4.50

A European environmental research program is proposed based on satellites. Using NOAA satellite data, it is shown how environmental research satellites can already contribute to the consideration of supraregional planning. Problems concerning waste disposal and storage, and its discharge into the air and water are discussed based on satellite data. A model investigation is proposed covering a region which includes the North of France, South Belgium, and the North Rhine-Westphalia area. This region contains an extreme agglomeration of industry and urban areas. ESA

N76-24760# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.
SATELLITE BASE DATA USED FOR AN ECONOMICAL REMOTE SENSING PROGRAM [SATELLITEN-BASISDATEN (SBD) ALS AUSGANG FUER EIN OEKONOMISCHES ERDERKUNDUNGSPROGRAMM - REMOTE SENSING]
Heinz Kaminski 1975 41 p refs In GERMAN Presented at the DFVLR and DFG Seminary on Remote Sensing, Porz-Wahn, West Germany, 7-11 Apr. 1975
Avail: NTIS HC $4.00

A number of examples is given to illustrate the application of IR remote sensor data to pollution and regional planning problems in Europe. The data is available from NOAA 2 and NOAA 3 satellites practically without cost, and the processing costs thereof are within realistic limits. ESA

N76-24761# Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.
ENVIRONMENTAL HAZARD ASSESSMENT REPORT: CHLORINATED NAPHTHALENES Final Report
Frank D. Kover Dec. 1975 43 p refs
(PB-248834/4; EPA-560/8-75-001) Avail: NTIS HC $4.00 CSCL 07A

The report is an analysis of available information on chlorinated naphthalenes pertinent to an assessment of the potential environmental hazard posed by these compounds. Aspects discussed are environmental exposure factors, biological effects, general information on uses, production and chemical properties as well as associated handling practices, and applicable standards and regulations. Conclusions as to current hazard potential are presented and recommendations for further study made. GRA

N76-24762# Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.
ENVIRONMENTAL HAZARD ASSESSMENT REPORT: HIGHER BENZENEPOLYCARBOXYLATES Final Report
Frank J. Letkiewicz Nov. 1975 25 p refs
(PB-248835/1; EPA-560/8-75-002) Avail: NTIS HC $3.50 CSCL 06F

This report is an analysis of available information on the higher benzenepolycarboxylates (i.e., Benzenecarboxylates through benzenehexacarboxylate) pertinent to an assessment of the potential environmental hazard posed by these compounds. Aspects discussed are production and uses of the subject compounds, environmental aspects and biological aspects. The study concludes that current uses of these compounds do not present an environmental hazard, but makes recommendations for additional studies to be undertaken prior to initiation of new and potentially dispersive uses. GRA

N76-24763# Nebraska Univ., Omaha. Coll. of Medicine.
LEAD: ENVIRONMENTAL SOURCES AND RED CELL TOXICITY IN URBAN CHILDREN Final Report
Carol R. Angle and Matilda S. McIntire Jun. 1975 92 p refs (Grant EPA-R-802043)
(PB-249061/3; EPA-650/1-75-003) Avail: NTIS HC $5.00 CSCL 07A

The occurrence of lead in multiple sources was correlated with the increased blood lead of urban children. In the age groups, 2-5, 10-12, and 14-18 years, urban children had higher blood leads than their suburban counterparts, although the difference decreased with age. The increased blood lead correlated with increased lead in the urban dustfall, yard soil and boot tray lead. There was no significant urban-suburban difference in air lead, housedust lead, available paint chips or lead in milk and water. Lead in yard dirt and blood lead both correlated with residential proximity to traffic. Although all blood lead were below 40 micrograms/dustfall lead, there was a significant linear decrease in red cell (rbc) membrane Na/K ATPase as blood lead increased; children with a blood lead above 20 micrograms/dustfall lead had decreased activity of rbc glutathione and increased rbc G-6-PD and 6-PGD. The increase in the latter two enzymes supports decreased rbc survival at the level of lead exposure of urban children. GRA

N76-24764# Baird-Atomic, Inc., Bedford, Mass.
OPTIMIZATION AND EVALUATION OF A FLUORESCENCE OIL SPILL DETECTOR. VOLUME 2: PROTOTYPE DESIGN Final Report, Dec. 1974 - May 1975
Herman G. Eldering and William A. Webb May 1975 30 p (Contract DOT-CG-43845-A; CG Proj. 7542.4.1)
(AD-A016464; USCG-D-109-Vol-2; Rept-5/75-6233-Vol-2) Avail: NTIS CSCL 07/4

This report reviews the operational and technical requirements of a low cost harbor surveillance unit and describes the design of a Scanning Oil Spill Detector. Operational considerations such as coverage resulted in a design containing both azimuth and elevation scanning. The incremental cost of scanning is less than the cost of additional units needed to provide the additional coverage. GRA

N76-24765# Houston Research, Inc., Tex.
SYSTEM FOR TOTAL DIRECT RECYCLE OF SECONDARY MUNICIPAL WASTEWATER. VOLUME 1: DESIGN CONCEPTS Final Report, 15 May 1973 - 1 Dec. 1974
Charles E. Mauk, Satish L. Gandhi, Robert W. Legan et al Kirtland AFB, N. Mex. AFWL Jun. 1975 157 p refs
(Contract F29601-73-C-0094; AF Proj. 21033W13)
(AD-A011938; AFWL-TR-74-235-Vol-1) Avail: NTIS CSCL 13/2

A study was performed leading to the design of a system to treat municipal secondary effluent to potable quality and allow closed-loop water utilization. A comprehensive literature survey resulted in the acquisition of 800 papers and reports on all advanced wastewater treatment processes. Summary evaluations were prepared for the important processes. A definition of a set of potable water quality criteria parameters was developed for the specific case of closed-loop water reuse. Mathematical models for performance and costs were complied for the individual processes. A computer program in FORTRAN was assembled incorporating the cost and performance models of the processes as subroutines. The resulting computer program represents a mathematical model of the conceptual system and can be used to perform design calculations of optional combinations of the processes. GRA

N76-24766# Dow Chemical Co., Midland, Mich. Contract Projects Lab.
FEASIBILITY STUDY AND CONCEPTUAL DESIGN OF A PROCESS TO RECOVER SO2 FROM SULFURIC ACID PLANT TAIL GAS Final Report, 1 Mar. 1974 - 30 Sep. 1975

W. F. Nekervis, J. R. Frost, M. R. Frick, and G. W. Lyon Oct. 1975 88 p refs
(Contract DAAA21-74-C-0259)
(AD-A019009; CPL-56) Avail: NTIS CSCL 13/2

The feasibility of absorbing in diethylene glycol, SO2 from air containing 1000 ppm SO2 and desorbing the SO2 for recovery was confirmed. A design is given for use at new sulfuric acid facilities at munition plants. Development was discontinued because the tail gas could contain 0.1% of H2SO4, SO3 and NO sub X, which could react to form explosive dinitrate.
Author (GRA)

N76-24767# Daedalean Associates, Inc., Woodbine, Md.
EVALUATION OF MEMBRANE OIL POLLUTION PREVENTION SYSTEM RESEARCH CONDUCTED FOR THE UNITED STATES COAST GUARD AND THE UNITED STATES NAVY Final Report, 17 Mar. - 29 Aug. 1975
A. A. Hochrein, Jr., J. D. Helm, and A. P. Thiruvengadam 29 Aug. 1975 69 p refs
(Contract DOT-CG-52312)
(AD-A018945; USCG-D-175-75) Avail: NTIS CSCL 13/2

This report reviews and evaluates the research and engineering development efforts on the membrane oil pollution prevention system (MOPPS) conducted for the U.S. Coast Guard and U.S. Navy. Scale model tanks were used to define and evaluate problems associated with the dynamic response of membrane configurations under simulated operating conditions. A commercially available neoprene-nylon-nitrile elastomer has been determined to be the best material for the membrane. Evaluation of the physical properties of the full scale thickness material indicates that the elastomer can withstand abrasion, oil immersion, creasing, wrinkling and pressure fluctuations. Preliminary results indicate little susceptibility to biodeterioration. GRA

N76-24768# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
A PRESENT VALUE-UNIT COST METHODOLOGY FOR EVALUATING WASTEWATER RECLAMATION AND DIRECT REUSE AT A MILITARY BASE OF OPERATIONS Technical Report, Jun. 1973 - May 1974
Vincent J. Ciccone Dec. 1974 19 p refs
(DA Proj. 1G7-62708-DJ-39)
(AD-A012175; USAMERDC-2123) Avail: NTIS CSCL 13/2

A relevant unit cost figure, called the present value-unit cost (PVUC), is determined and applied to alternative methods for meeting a projected need for water. The concepts of reclamation and dual supply systems are introduced and presented as feasible alternatives. An hierarchy of water use is established, with the highest quality intended for potable purposes. A lesser quality is provided for nonpotable uses. A mathematical model is formulated and coded in FORTRAN for use on a digital computer. The model incorporates the direct reuse of these waters after specified advanced treatment. The technique used for economic evaluation is the present value method, by which a direct comparison between alternatives may be made. The model focuses on the relationship of a demand for water and alternative methods to satisfy that requirement. GRA

N76-24769# Army Construction Engineering Research Lab., Champaign, Ill.
INSTALLATION SOLID WASTE SURVEY GUIDELINES Final Report
Gary W. Schanche, Larry A. Greep, and Bernard Donahue Oct. 1975 72 p refs
(DA Proj. 4A1-62121-A-896)
(AD-A018879; CERL-TR-E-75) Avail: NTIS CSCL 13/2

This report is one of a series on air pollution, water pollution, and solid waste survey guidelines. It is primarily for the use of installation planning, operating, and maintenance personnel. Guidelines for development of a comprehensive solid waste management plan are presented. The report contains information on determination of legal constraints, characterization of specific waste sources, evaluation of current management programs, and establishment of survey requirements. Techniques for the determination of the physical composition of waste streams and the amounts of waste material are described, along with guidelines for developing sampling programs. Author (GRA)

N76-24770# Louisville Univ., Ky.
FATE AND EFFECTS OF OIL POLLUTANTS IN EXTREMELY COLD MARINE ENVIRONMENT Annual Report for 1975
Ronald M. Atlas 31 Dec. 1975 43 p refs
(Contract N00014-74-A-0180-0001)
(AD-A018711) Avail: NTIS CSCL 13/2

The biodegradability of Prudhoe crude oil in the Arctic was studied in flow-through chemostats. Oil biodegradation was enhanced by addition of nitrogen and phosphorus. Enhancement of biodegradation was greater for an oleophilic fertilizer than a water-soluble fertilizer, even with repeated addition of the soluble fertilizer. In addition to Prudhoe crude, Arctic Diesel and JP5, as well as fractions of Prudhoe crude and individual hydrocarbons, were shown to be subject to biodegradation at low temperature by microorganisms indigenous to Arctic water and sediment, providing nitrogen and phosphorus were also added. No evidence, however, was obtained for biodegradation of Prudhoe crude oil spilled over or under sea ice. Contamination with crude oil or exposure to SO2 were found to inhibit essential algal and lichen metabolic functions. Natural gas was not inhibitory to these same organisms. Prudhoe crude oil and Arctic Diesel were found to be toxic to Arctic amphipods. The toxicity appears to be associated to a greater degree with the paraffinic fraction than with the aromatic or asphaltic fractions. GRA

N76-24771# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
NATURAL METHODS OF PURIFYING WASTE WATERS AND UTILIZING THEM IN AGRICULTURE. BIBLOGRAPHY, PARTS 1 AND 2
A. I. Lvovich Dec. 1975 206 p Transl. into ENGLISH from the book "Bibliografiya po Estestv. Sposobam Ochistki Stochnykh Vod i Isposzoranie ikh v Selskom Khozyaistve" Moscow, pt. 1, pt. 2, 1964, 1971
(AD-A019105; CRREL-TL-505) Avail: NTIS CSCL 02/3

This bibliography gives a list of Russian published material on agricultural utilization of waste waters and natural methods of purifying them on agricultural and municipal irrigation fields. Materials on questions of self-purification of the soil from pollutants and sanitary and hygenic evaluations of soil methods are presented as completely as possible. The bibliography was updated in 1971 to contain a total of 2,200 titles. GRA

N76-24772# New Mexico Univ., Albuquerque. Civil Engineering Research Facility.
STUDY OF ALTERNATE FUELS AND WATER SPRAY INJECTION AS METHODS OF SMOKE ABATEMENT FOR CRASH RESCUE TRAINING FIRES Final Report
William T. Ristau and Richard B. Lehmann Kirtland AFB, N. Mex. AFWL Dec. 1975 39 p refs
(Contract F29601-72-C-0024)
(AD-A018742; AFWL-TR-73-153) Avail: NTIS CSCL 13/2

Two methods were investigated to reduce emissions from the open burning of fuels which is necessary for crash rescue training exercises. Cleaner burning fuels were examined but they did not reduce the emissions to an acceptable level on large-scale fires (50-foot-diameter fires). The addition of a fine water spray using a specific spray nozzle just above the fuel bed of a JP-4 fire did result in a much cleaner burning fire with a significant decrease in all pollutants measured. GRA

N76-24773# Coast Guard Research and Development Center, Groton, Conn.
A COMPUTER SIMULATION TECHNIQUE FOR OIL SPILLS OFF THE NEW JERSEYDELAWARE COASTLINE Final Report
Martin C. Miller, Jerry C. Bacon, and Ivan M. Lissauer Sep. 1975 50 p refs
(AD-A018947; CGR-DC-24/75; USCG-D-171-75) Avail: NTIS CSCL 13/2

Predictions of the movement of oil slicks and their impact locations along the shoreline of New Jersey and Delaware were determined for two potential deepwater ports and two potential drilling sites. A hydrodynamical-numerical model for the New York Bight area was coupled with a wind generating model to produce temporal patterns of concentration of oil. Shoreline impact determinations were made for the four spill sites for the average

winter storm conditions and average summer high pressure systems generated by the models. GRA

N76-24774# Coast Guard Research and Development Center, Groton, Conn.
PREDICTED OIL SLICK MOVEMENT FROM VARIOUS LOCATIONS OFF THE NEW JERSEY/DELAWARE COASTLINE Final Report
Ivan M. Lissauer and Jerry C. Bacon Jun. 1975 132 p refs (AD-A019019; CGR-DC-13/75; USCG-D-137-75) Avail: NTIS CSCL 13/2

Projections of the movement of oil slicks and their impact location along the shoreline of New Jersey and Delaware were determined from three potential deepwater port sites and three potential oil drilling sites. Average monthly wind speeds and directions and average monthly current patterns were used for predicting the oil slick movement. Probable areas of impact along the shoreline were indicated. Author (GRA)

N76-24775# Water Resources Council, Washington, D.C. Committee on Sedimentation.
PROCEEDINGS OF THE FEDERAL INTER-AGENCY SEDIMENTATION CONFERENCE (3D)
1976 974 p refs Conf. held at Denver, 22-25 Mar. 1976 (PB-245100/3; SEDCOM-03) Avail: NTIS HC $23.75 CSCL 13B

In the 13 years since the last conference, there has been a large amount of research and development work. The work group recommended that a third conference be held in March 1976. Of the 130 workers in sedimentation who indicated a willingness to prepare and present papers at this Third Federal Inter-Agency Conference on Sedimentation, the committee has accepted about 80 papers for publication in the proceedings. The broad topics covered are the following: (1) sediment yield and sources; (2) erosion and sediment control; (3) physical and chemical properties of sediment; (4) sediment transport and deposition; (5) channel adjustments; (6) coastal zone sedimentation; and (7) instrumentation. GRA

N76-24776# Calspan Corp., Buffalo, N.Y.
DETECTION OF OIL IN SEWERS Final Report, Jul. 1968 - Feb. 1971
Ditmar H. Bock and Elmer H. Eckert Feb. 1976 34 p refs (Grant EPA-WPRD-263-01-68)
(PB-249359/1; EPA-600/2-76-027) Avail: NTIS HC $4.00 CSCL 13B

Methods for detecting oil in waste water were selected which can measure quantities from as small as those in a surface active film to massive accumulations. It was found that more techniques can be adapted to the thick oil than to the thin oil detection problem because thick oil can be measured by electrical and thermal conductivity devices which require little maintenance in sewer use whereas detectors of small amounts are less suited to the sewer environment. The most promising techniques developed used RF and heat conductivity sensors for the detection of massive oil accumulations from a few millimeters to several meters thick and ultraviolet transmission sensors for the detection of dispersed oil over the range of 5 to 10,000 parts per million. The instrumentation was tested and found to be capable of unattended operation for periods ranging from a week to several months. Telemetry was used to permit readout at a remote central location. GRA

N76-24777# Los Angeles County Sanitation District, Whittier, Calif.
STATE OF THE TECHNOLOGY SEMI-AUTOMATIC CONTROL OF ACTIVATED SLUDGE TREATMENT PLANTS
Carl A. Nagel Dec. 1975 213 p refs
(Contract EPA-R-803055)
(PB-249067/0; EPA-600/2-75-058) Avail: NTIS HC $7.75 CSCL 13B

The report documents the theory, design and operation of continuous on-line instrumentation currently in use by the County Sanitation Districts of Los Angeles County California and further describes computer applications which provide daily operational calculations. Instrumentation sections include water level control of influent pumping, density control of primary sludge pumping, and process air, return sludge and waste sludge control in cultivated sludge plants. Theory, design, operation and maintenance characteristics, maintenance requirements, and results are presented for each system. A computer application system is described which provides daily operational parameters to the operators and prepares monthly summary of operations reports. GRA

N76-24778# National Academy of Sciences - National Research Council, Washington, D.C. Panel on Vapor-Phase Organic Pollutants.
VAPOR-PHASE ORGANIC POLLUTANTS: VOLATILE HYDROCARBONS AND OXIDATION PRODUCTS Final Environmental Health Effects Research Series Report
Oct. 1975 672 p refs
(Contract EPA-68-02-0542)
(PB-249357/5; EPA-600/1-75-005) Avail: NTIS HC $16.25 CSCL 13B

Sources of vapor phase organic pollutants are listed, including sampling techniques and analytical methods. Possible mechanisms of formation of oxygenated organic hydrocarbon compounds in the atmosphere and of atmospheric reactions of oxides of nitrogen and sulfur are studied. Toxicologic, pathophysiologic, and epidemiologic information on vapor phase organic pollutants is reviewed along with their metabolism, and effects on the total environment. Special attention is given to oxidized compounds, formaldehyde, ozone, and benzene. The importance of oxidation reactions in the vapor phase and the human health hazards produced from transient products of oxidation are stressed. The review of metabolism indicates that, although vapor phase hydrocarbon pollutants are modified usually by enzymatic oxidation within mammalian systems from nonpolar to polar compounds (which are then excreted by the kidney), this sometimes occurs with the production of toxic intermediates. These reactions occur mostly in the liver and to a lesser extent in the kidney, intestine, and lung. GRA

N76-24779# Midwest Research Inst., Kansas City, Mo.
EVALUATION OF SONICS FOR FINE PARTICLE CONTROL Final Environmental Protection Technology Series Task Report
R. Hegarty and L. J. Shannon Jan. 1976 52 p refs
(Contract EPA-68-02-1324)
(PB-249315/3; EPA-600/2-76-001) Avail: NTIS HC $4.50 CSCL 13B

Results are given of an evaluation of the potential of sonic agglomeration as a means of improving capabilities for controlling fine particle emissions. Available theoretical and experimental information indicates that sonic agglomerators can increase the mean particle size of aerosols; however, the energy requirements are quite high when the gas stream contains predominantly fine particulates. Ideal energy levels are not very competitive with other devices capable of removing fine particulates, especially when a high efficiency control system is required as a collector in order to minimize energy consumption in the sonic agglomerator. GRA

N76-24780# Michigan Univ., Ann Arbor.
THE EFFECTS OF SEWAGE EFFLUENT ON WETLAND ECOSYSTEM Semiannual Report
Robert H. Kadlec, John A. Kadlec, Curtis J. Richardson, and Donald L. Tilton Dec. 1975 197 p
(Grant NSF GI-34812)
(PB-249192/6; NSF/RA/E-75-060; SAR-4) Avail: NTIS HC $7.50 CSCL 13B

An ongoing study of the nutrient status of the surface and interstitial waters of peatlands in Michigan is presented. The contact of influent water with mineral soil and the length of travel through peat after such contact are key factors determining vegetation. The balance between influent ground water and rain water as sources of nutrients for plant growth are considered to determine the plant communities. An examination of the major ecosystem components with a view to predicting and monitoring these changes was conducted. The dissolved nutrients of the peatland, their variation in time and space, and the impact of small scale nutrient additions are considered. GRA

N76-24781# City of Hollywood, Fla.
RAW SEWAGE COAGULATION AND AEROBIC SLUDGED

DIGESTION Final Report
Richard H. Jones, T. A. Burnszytnsky, and John D. Crane Nov. 1975 126 p refs Prepared in cooperation with Environ. Sci. and Eng., Inc.
(PB-249107/4; EPA-600/2-75-049) Avail: NTIS HC $6.00 CSCL 13B

Laboratory and full-scale studies were conducted at the Hollywood, Florida, sewage treatment plant to determine the efficiency of chemical coagulation for treatment of raw sewage and aerobic digestion of primary sewage sludge. While various polyelectrolytes produced high treatment efficiencies in the laboratory, these efficiencies could not be achieved in full-scale tests due to inadequate mixing and higher soluble BOD concentrations. Sludges were successfully digested aerobically with as little as ten days detention. An oxygen uptake rate of up to 1.8 gm O2/(gm T.S.)(hr) was observed for sludge ages greater than 20 days. GRA

N76-24782# Greene County Board of Commissioners, Ohio.
IMPROVED LIQUID-SOLIDS SEPARATION BY AN ALUMINUM COMPOUND IN ACTIVATED SLUDGE TREATMENT Final Report, Oct. 1974 - Jun. 1975
Charles F. Lenhart and Joe W. Cagle Sep. 1975 71 p refs Prepared in cooperation with Nalco Chemical Co.
(PB-248228/9; EPA-600/2-75-039) Avail: NTIS HC $4.50 CSCL 13B

Feeding liquid alkaline alumina, identified as sodium aluminate, to a small to medium (2.5 million gal per day) activated sludge wastewater treatment plant is demonstrated as a practical method of gaining several operational benefits. Specific benefits found in the areas of solids handling and ease of sludge volume index control discussed. Additional benefit is noted in the concentration of aerobically digested solids, particularly in cold weather. Reduction of suspended solids carryout of secondary clarifiers resulted from the sodium aluminate feed, reducing the loading to the tertiary treatment unit. GRA

N76-24783# Chicago Univ., Ill. Center for Urban Studies.
AIR POLLUTION AND URBAN LAND USE POLICY
George S. Tolley and Alan S. Cohen Jan. 1975 12 p Prepared in cooperation with Argonne Natl. Lab., Ill.
(Grant NSF GI-32989)
(PB-249122/3; NSF/RA/E-75-055) Avail: NTIS HC $3.50 CSCL 13B

The dependence of physical and economic effects of air pollution on urban spatial arrangements in the setting of Chicago is examined. Guidelines for employing land use policy in air pollution control are suggested. First, through an experiment in urban form, the potential impacts of land use policy on air pollution are quantified. Second, via an experiment in air pollution spillover effects, economic costs of air pollution dispersed into a community from outside are investigated. Together, these two experiments indicate both the potential benefits and limitations of controlling air pollution through land use policy actions. GRA

N76-24784# Calspan Corp., Buffalo, N.Y.
AUTOMOBILE EXHAUST EMISSION SURVEILLANCE ANALYSIS OF THE FY 1973 PROGRAM
Jeffrey Bernard, Paul Donovan, and H. T. McAdams Jul. 1975 65 p refs
(Contract EPA-68-03-0486)
(PB-248600/9; EPA-460/3-75-007) Avail: NTIS HC $4.50 CSCL 13B

The emission factor program provides a realistic assessment of the effectiveness of Federal air pollution regulations by testing production vehicles in the hands of the motoring public. This report summarizes the results of the FY 73 Emission Factor Program and compares these results with those obtained in an earlier emission factor program. The FY 73 Program tested 1,080 1967 to 1974 model year vehicles in six cities. GRA

N76-24785# SCS Engineers, Long Beach, Calif.
DEMONSTRATED TECHNOLOGY AND RESEARCH NEEDS FOR REUSE OF MUNICIPAL WASTEWATER Final Report, Jun. 1972 - Mar 1974
Curtis J. Schmidt and Ernest V. Clements, III May 1975 338 p refs
(Contract EPA-68-03-0148)
(PB-249151/2; EPA-670/2-75-038) Avail: NTIS HC $10.00 CSCL 13B

The survey identified 358 sites at which direct reuse of municipal wastewater was being practiced. Detailed data were gathered on volume, effluent quality, treatment, reliability and economics. It was found that direct reuse of municipal wastewater was not widespread accounting for less than 2% of this nation's water use in 1972. Irrigation and industrial cooling account for virtually all of this reuse. Only three sites practice reuse for recreational lakes, and one for nonpotable domestic use. Potable reuse is not presently practiced. General quality standards could not be derived for any category. In fact, water which is substandard according to published criteria is being successfully used in many reuse situations by fitting the water quality to the specific local condition. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N76-24786 Pennsylvania State Univ., University Park.
A SIMULATION OF TURBULENCE IN THE ATMOSPHERIC BOUNDARY LAYER Ph.D. Thesis
Bryan Richard Kerman 1975 178 p
Avail: Univ. Microfilms Order No. 76-10744

A method of simulating a turbulent time series by filtering a white noise series is discussed. The development of linear filters from empirical spectra is expanded for forms based on boundary layer similarity under stratification and for generalized spectral shapes. Some properties of the filters under various stratifications, heights and viscosities are examined. The method of linear simulation is extended to multi-component processes by the diagonalization of the spectral matrix, spectral factorization of the eigenvalues, followed by a rotation involving a special unitary transformation. The method is extended to several nonlinear, non-Gaussian models based on ad hoc approximations of the kernel interactions. It is found that the method of separable kernels for a representation of velocity is inappropriate for simulating the characteristic inertial transfer of turbulent energy. However, the separable kernel representation of acceleration better approximates the energy transfer in the viscous subrange for sufficiently small Reynolds numbers. Dissert. Abstr.

N76-24787 Pennsylvania State Univ., University Park.
RADIATION FORCE IN PLASMAS AND APPLICATION TO IONOSPHERE MODIFICATION Ph.D. Thesis
Paul James Moser 1975 121 p
Avail: Univ. Microfilms Order No. 76-10769

The radiation force of electromagnetic waves propagating in plasma is explained in terms of field behavior and plasma characteristics. The force was studied in detail for a specific plasma distribution where the complete closed form solutions for the electromagnetic fields are available, and the theory was checked by conservation of momentum. The theory was then applied to the problem of ionosphere modification by high power high frequency radio waves. Dynamics of the modification were described by conservation equations for electron thermal energy, ion thermal energy, plasma momentum and number of particles. In addition to density and temperature variations which appear in the model close to the reflection level, special attention was given to the standing wave effects at lower altitudes where plasma density striations appear. It was concluded that usual experimental methods cannot distinguish the effects of the radiation force from those of heating in contemporary ionosphere modification experiments. Dissert. Abstr.

N76-24788 New Hampshire Univ., Durham.
AURORAL PARTICLE ACCELERATION BY FIELD ALIGNED POTENTIALS Ph.D. Thesis
David Norton Walker 1975 118 p
Avail: Univ. Microfilms Order No. 76-11687

A simple scatter-free model of parallel electric field acceleration was developed, and its predictions were compared to data

gathered by detectors aboard sounding rocket flights. For the purpose of developing the model an initially Maxwellian plasma was assumed which was then allowed to fall through a potential drop. From this basic idea, a number of models were developed by varying the injection position, mirror effect parameters, number and form of accelerating potentials, etc. It was concluded that in the simplest scatter-free case these models were insufficient to describe the data adequately. For the purpose of explaining the difference between the model and the data, multiple sources, scattering and fluctuations were studied. It was concluded that the data could be sufficiently represented with either a one source or a two source model if one allowed wave-particle scattering to occur. Dissert. Abstr.

N76-24789 Institut d'Aeronomie Spatiale de Belgique, Brussels.
A PROGRAMMABLE CONTROL UNIT FOR A BALLOON BORNE QUADRUPOLE MASS SPECTROMETER
E. Arijs and D. Nevejans 1975 26 p refs Submitted for publication
(Aeronomica-Acta-A-154-1975) Avail: Issuing Activity

In order to determine the ion composition of the stratosphere a balloon-borne mass spectrometer consisting of a quadrupole mass filter was built requiring a special quadrupole control unit. This unit measures the ion counting rate in mass domains rather than at definite mass peaks. In addition, the underlying principles as well as the performance of this unit, the heart of which consists of two programmable read only memories and permits the choice of 16 different measuring jobs by 6 telecontrol channels, are described. Author (ESA)

N76-24790 Institut d'Aeronomie Spatiale de Belgique, Brussels.
VARIATIONS OF EXOSPHERIC TEMPERATURE AND ATMOSPHERIC COMPOSITION BETWEEN 150 AND 1100 km IN RELATION TO THE SEMIANNUAL EFFECT
J. Vercheval 1975 18 p refs Presented at the 18th COSPAR Meeting, Varna, Bulgaria, 29 May - 7 Jun. 1975 Submitted for publication
(Aeronomica-Acta-A-155-1975) Avail: Issuing Activity

The degree of agreement between the semiannual density variations as suggested and described in the Jacchia atmospheric model and the changes, during the year, of the O, O2, and N2 densities computed under diffusive equilibrium with the observed values, at 150 km, as lower boundary condition were analyzed. For the altitude range 150 to 500 km, N2, O2 and O densities were computed with diffusive equilibrium conditions using observed values at 150 km as lower boundary condition. The resulting total density is compared with Jacchia's models. To obtain a good coherence, a correction of the atomic oxygen number density, at 150 km is necessary for the June solstice. Such a corrected semiannual variation of atomic oxygen agrees with the variation deduced from incoherent scatter observations at 200 km. A semiannual variation of the exospheric temperature is also confirmed. With such conditions, the helium behavior is deduced up to 1100 km. Author (ESA)

N76-24791 Institut d'Aeronomie Spatiale de Belgique, Brussels.
STRATOSPHERIC OZONE. AN INTRODUCTION TO ITS STUDY
M. Nicolet 1975 186 p refs Submitted for publication
(Aeronomica-Acta-A-156-1975) Avail: Issuing Activity

The various reactions in which ozone and atomic oxygen are involved in the stratosphere were analyzed, taking into consideration hydrogen, nitrogen, and chlorine compounds. In the upper stratosphere, above the ozone peak, where there is no strong departure from photochemical equilibrium conditions, the action of hydroxyl and hydroperoxyl radicals, of nitrogen dioxide and chlorine mono-oxide on atomic oxygen and of atomic chlorine on ozone can be introduced. At the lower stratosphere, below the ozone peak, there is no important photochemical production of O3 but various possibilities of transport. The predictability of the action of chemical reactions depends strongly on important interactions (1) between OH and HO2 radicals with CO and NO, respectively, and affecting the ratio n(OH)/n (HO2) at the tropopause level; (2) between OH and NO2 leading to the formation of nitric acid with its downward transport towards the troposphere; (3) between NO and HO2 leading to NO2 and its subsequent photodissociation; (4) between ClO and NO leading also to NO2 and becoming more important than the reaction of ClO with O, and (5) between Cl and various molecules such as CH4, H2 leading to HCl with its downward transport towards the troposphere. All of these chemical processes are subject to many changes since they occur in the lower stratosphere where seasonal, latitudinal, and even day-to-day variations of the ozone concentrations are observed in association with advective and dynamic transports which depend on meteorological conditions as indicated by variations of tropopause heights. Author (ESA)

N76-24792 Institut d'Aeronomie Spatiale de Belgique, Brussels.
STRATOSPHERIC HCL FROM INFRARED SPECTRA
M. Ackerman, D. Frimout, A. Girard, M. Gottignies, and C. Muller 1976 10 p refs Submitted for publication
(Aeronomica-Acta-A-158-1975) Avail: Issuing Activity

Measurements of the vertical distribution of hydrochloric acid in the stratosphere up to 34 km are reported. HCl was observed in the stratosphere from balloon borne spectroscopic measurements of a portion of the fundamental band in the 3 microns wavelength region. The observation of absorption lines using the sun as a source at solar zenith angles larger than 90 deg indicates an HCl volume mixing ratio equal to (3.8 + or - 1.5) x 10 to the minus 10th power at 20 km increasing with altitude at least up to 30 km where the value is (1.4 + or - 0.6) x 10 to the minus 9th power. The total zenith amount above 21 km is found to be (10 + or - 3.5) x 10 to the 14th power/sq cm in agreement with previous observations performed up to this altitude. A maximum number density equal to (7.2 + or - 3) x 10 to the 8th power/cu cm is observed at 24 + or - 2 km altitude. Author (ESA)

N76-24793 Institut d'Aeronomie Spatiale de Belgique, Brussels.
STRATOSPHERIC BALLOON OBSERVATIONS OF THE SOUTHERN INTERTROPICAL ARC OF AIRGLOW IN THE SOUTH AMERICAN AREA
G. Weill, J. Christophe, C. Lippens, M. Ackerman, and Y. Sahai 1976 19 p refs Presented at the 20th Symp. Intern. d'Astrophys., Liege, 17-20 Jun. 1975
(Aeronomica-Acta-A-157-1976) Avail: Issuing Activity

Multispectral observations of the intertropical arc over a large area are reported from a stratospheric balloon launched on Feb. 27, 1973, floating at 38 km ceiling altitude, flying in the southern tropical region in the vicinity of the Brazilian magnetic anomaly. The structure of thermospheric 5577 emission is clearly distinguishable from the lower altitude emission layer. Intensity ratios of 5577/6300 can be used as a sensitive height indicator for the dissociative recombination layer. A determination is made of the branching ratio of ionospheric recombination into the 1S and 1D metastable states of OI. The peak ionization in the anomaly is positioned in space through the emission of 7774 permitted OI lines. The spatial separation of the allowed and forbidden emission regions is variable and sometimes exceeds 300 km. It implies that the spread of ionization in the anomaly is also variable and sometimes considerable. ESA

N76-24794*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
OBSERVATION OF ACOUSTIC-GRAVITY WAVES IN THE UPPER ATMOSPHERE DURING SEVERE STORM ACTIVITY
R. J. Hung Jul. 1975 74 p refs
(Contract NAS8-30616)
(NASA-CR-144293) Avail: NTIS HC $4.50 CSCL 04A

A nine-element continuum wave spectrum, high-frequency Doppler sounder array has been used to detect upper atmospheric wave-like disturbances during periods with severe weather activity, particularly severe thunderstorms and tornadoes. Five events of severe weather activity, including extreme tornado outbreak of April 3, 1974, were chosen for the present study. The analysis of Doppler records shows that both infrasonic waves and gravity waves were excited when severe storms appeared in the north Alabama area. Primarily, in the case of tornado activity, S-shaped Doppler fluctuations or Doppler fold-backs are observed, while quasi-sinusoidal fluctuations are more common in the case of thunderstorm activity. A criterion for the production of Doppler fold-backs is derived and compared with possible tornado conditions. Author

N76-24795*# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
STUDIES OF EARTH SIMULATION EXPERIMENTS Final Report, 1 Mar. 1975 - 31 May 1976
John E. Hart 1 May 1976 67 p refs
(Contract NAS8-31149)
(NASA-CR-144312) Avail: NTIS HC $4.50 CSCL 04A

The theoretical design of an experiment to study the rotational limits of astrophysical flows is presented along with results of preliminary laboratory tests of a prototype. L.S.

N76-24796# Committee on Aeronautical and Space Sciences (U. S. Senate).
STRATOSPHERIC OZONE RESEARCH AND EFFECTS
Washington GPO 1976 584 p refs Hearings before Subcomm. on the Upper Atmosphere of Comm. on Aeron. and Space Sci., 94th Cong., 2d Sess., 25 Feb., 1 Mar. 1976
(GPO-67-044) Avail: SOD HC $4.80

Testimony is given on the effects of reduced stratospheric ozone on the Earth's weather and climate and on how the Earth's biological systems would be affected because of enhanced ultraviolet radiation at the surface. The NASA program plan for upper atmospheric research, technology, and monitoring is stressed. J.M.S.

N76-24797*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEFINING CONSTANTS, EQUATIONS, AND ABBREVIATED TABLES OF THE 1975 US STANDARD ATMOSPHERE
R. A. Minzner, C. A. Reber, L. G. Jacchia, F. T. Huang, A. E. Cole, A. J. Kantor, T. J. Keneshea, S. P. Zimmerman, and J. M. Forbes Washington May 1976 77 p refs
(NASA-TR-R-459; G-7659) Avail: NTIS HC $5.00 CSCL 04A

The U.S. Standard Atmosphere, 1975 (COESA, 1975) is an idealized, steady-state representation of the earth's atmosphere from the surface of the earth to 1000-km altitude, as it is assumed to exist in a period of moderate solar activity. From 0 to 86 km, the atmospheric model is specified in terms of the hydrostatic equilibrium of a perfect gas, with that portion of the model from 0 to 51 geopotential kilometers being identical with that of the U.S. Standard Atmosphere, 1962 (COESA, 1962). Between 51 and 86 km, the defining temperature-height profile has been modified from that of the 1962 Standard to lower temperatures between 51 and 69.33 km, and to greater values between 69.33 and 86 km. Above 86 km, the model is defined in terms of quasi-dynamic considerations involving the vertical component of the flux of molecules of individual gas species. These conditions lead to the generation of independent number-density distributions of the major species, N2, O2, O, Ar, Ne, and H, consistent with observations. The detailed definitions of the model are presented along with graphs and abbreviated tables of the atmospheric properties of the 1975 Standard. Author

N76-24798*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
F SUB 2 PEAK ELECTRON DENSITIES IN THE MAIN TROUGH REGION OF THE IONOSPHERE
Barry W. Halcrow May 1976 57 p refs
(Grant NGL-39-009-003)
(NASA-CR-147153; PSU-IRL-IR-55) Avail: NTIS HC $4.50 CSCL 04A

A study of the main trough in the F2 region was made using observations from Alouette I and II. Parameters needed to predict the occurrence of the trough were determined from the many observations. These parameters were used to develop a modification factor for use with C.E.I.R. model of predicted MmF2. This modification factor reduced the C.E.I.R. model predicted NmF2 to more representative values of MmF2 in the main trough region. Author

N76-24799# Electrotechnical Lab., Tokyo (Japan).
CHARACTERISTICS OF NATURAL RADIOACTIVITY APPEARING IN ITS DIURNAL VARIATION
Sigeru Nakatani Oct. 1975 75 p refs
(Rept-755) Avail: NTIS HC $4.50

The characteristics of naturally occurring radioactivity were investigated in terms of the time variation of its concentration in the atmosphere. An outline of various types of time variation of the concentration of radioactivity occurring naturally in the atmosphere is presented along with methods of measuring the properties of natural radioactivity, especially the nature of size distributions of radioactive aerosols and the degree of equilibrium between radon-222 and its daughters in the air which are influenced by various conditions of the atmosphere. The first reason for the study was the need for investigation of the nature of airborne radioactivity that produces various effects on ionization and electric phenomena. Secondly, the concentration of the natural background activity occurring in Tokyo is important in view of the anticipated rise in activity level due to the use of various radioisotopes. In addition the effect of radioactive aerosols on the human body has attracted the attention of many researchers. The size distribution of radioactive aerosols and the degree of radioactive equilibrium among the radon daughters are closely related to the magnitude of the internal radiation doses. Author

N76-24800# Southwest Research Inst., San Antonio, Tex. Engineering Sciences Div.
A DETERMINATION OF SEISMIC FACILITY CAPABILITIES Final Report
Daniel D. Kana 2 May 1976 40 p. refs
(SWRI Proj. 02-9162-001)
Avail: NTIS HC $4.00

A medium-capacity seismic facility was developed for realistic simulation of earthquake environments, as well as all currently-accepted standard test approximations of such environments. In addition to providing a full-scale capability for performing qualification tests on a variety of components to be used in nuclear and conventional power generating stations, it is particularly suited to the study of structural models subject to scaled seismic excitation. Use of the facility for model experiments involves special requirements which are described. The broad capability of the system includes the simulation of a variety of seismic events, and immediate characterization of these events by appropriate engineering parameters. Excitation signals are provided typically by function generators or actual earthquake events recorded on analog tape. Real-time analyzers are used to provide a rapid plotting of response spectra, power spectral density, and other useful parameters. Author

N76-24801# Explosives Research and Development Establishment, Waltham Abbey (England).
SOLAR UV RADIATION MEASUREMENTS MADE THROUGHOUT 1972 AND 1973 AT ERDE AND JTRU
A. Davis, D. Gordon, G. V. Howell, and K. J. Ledbury Oct. 1974 24 p refs
(ERDE-TR-186; BR48403) Avail: NTIS HC $3.50

Global and diffuse solar UV were measured throughout 1972 and 1973 at the Joint Tropical Research Unit in Queensland and at the Explosives Research and Development Establishment, Waltham Abbey, Essex. The UV at 45 deg facing the equator was also measured at both sites. The results are discussed; in particular the relative importance of the diffuse and the direct components of solar UV is established and the factors which affect the UV content of solar radiation are indicated. From a consideration of the results the feasibility of estimating the UV dose solely from a knowledge of the total solar radiation is confirmed. Author (ESA)

N76-24802# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
HOT ZONE IN THE OUTER PLASMASPHERE OF THE EARTH
V. V. Bezrukikh and K. I. Gringauz 1975 20 p refs
(D-219) Avail: NTIS HC $3.50

The results of the ion effective temperature as determined from the Prognoz satellite launched on April 14, 1972, into an orbit with initial parameters: perigee 200.9 km, apogee 920 km, and inclination 65 deg, are presented. Owing to orbital peculiarities during one revolution about the earth the satellite crossed a certain L-shell at different altitudes, allowing the determination of the spatial distribution of the ion effective temperature in the plasmasphere not only in the equatorial plane but also far from it. ESA

N76-24803# Lamont-Doherty Geological Observatory, Palisades, N.Y.

PLATE TECTONICS AND THE DISCRIMINATION OF UNDERGROUND EXPLOSIONS FROM EARTHQUAKES Semiannual Technical Report, 1 Sep. 1971 - 30 Sep. 1975

Andrew J. Murphy Sep. 1975 12 p refs

(Contract F19628-71-C-0245; DARPA Order 1795)

(AD-A018855; AFCRL-TR-75-0567; SATR-8) Avail: NTIS CSCL 08/11

During the period covered by this semi-annual report (1 January to 30 June 1975), seven general topics of research have been investigated. (1) A study of anomalous events, earthquakes which plot near the explosion population in a (M sub s) - (m sub b) diagram, has concluded that all such anomalous events in the eastern Himalayas are natural earthquakes. (2) A study of a foreshock-mainshock-aftershock sequence is being conducted to determine if there are factors other than source depth focal mechanism that control the surface wave magnitude of small events. (3) Three studies are in progress on the topic of Intraplate Tectonics. (4) A study comparing the motions in a half space near a fault with those which occur in a whole space if the surface were absent has been completed. (5) A study is currently in progress to test the validity of various models of the core-mantle boundary using seismograms synthesized by the Langer method of frequency domain calculations. (6) In another study, the excitation of higher mode surface waves by shallow events is being examined. (7) A study is also under way on the possible interrelation among buoyant zones, great earthquakes, and dynamic boundaries of subduction. GRA

N76-24804# Boston Coll., Chestnut Hill, Mass.

MODIFICATIONS AND ADDITIONS TO THE GEOKINETIC DATA ACQUISITION SYSTEM Final Report, 1 Jul. 1974 - 30 Jun. 1975

Howard W. Kuenzler, Anthony Sukiennik, Joseph I. Blaney, Jr., and James Kimbrough Aug. 1975 68 p

(Contract F19628-75-C-0005; AF Proj. 7629)

(AD-A018785; AFCRL-TR-75-0434) Avail: NTIS CSCL 08/11

Mechanical and electrical modifications to the Geokinetic Data Acquisition System are discussed. The construction and operation of a Seismic Activity Monitor are described. The Seismic Activity Monitor is an unattended recorder designed to detect and record transient geophsical phenomena. The Monitor supplements the data collection capabilities of the Geokinetic Data Acquisition System. The programming required to input data tapes from the Seismic Activity Monitor to the analysis portion of the Geokinetic Data Acquisition System is detailed. Author (GRA)

N76-24805# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.

SEISMIC DATA ANALYSIS CENTER Final Report, Jul. 1973 - Jul. 1975

R. A. Hartenberger 28 Jul. 1975 66 p

(Contract F08606-74-C-0006; ARPA Order 1620)

(AD-A018737; SDAC-TR-75-11) Avail: NTIS CSCL 08/11

One of the more important results of this work was the performance of the seismic event processing systems. Of 265,453 primary automatic detections during the period, 16,344 were declared legitimate events after a second automatic detection run based on a more stringent criterion than the primary run, and after visual analysis; these were subsequently reported in daily and weekly summaries. During these two years of operation of the on-line and batch processors, the capabilities of the systems were improved by upgrading techniques and by modifying and correcting system software. Scientists at the SDAC completed and published 22 reports which deal with the seismological aspects of the work. Eight of the reports concerned the detection of seismic waves by arrays and networks. Seven reports dealt with test evasion and counter-evasion techniques, two studies described path affects, and one explained a new source theory. Of the four remaining reports, one described new source discriminates, two concerned the event location capability of a large array, and one was a special analysis of the Rio Blanco explosion. Six reports were completed in Network Research studies. Three of these evaluated the ILLIAC computer as a processor of seismic data, two reports evaluated the SDAC as network headquarters, and the last described seismic data files. In addition the design and documentation plans were completed for the revised LASA Processing System (LASAPS), for the new Detection Processor, and for the Network Event Processor. The coding, testing, and demonstration of the LASAPS system were also completed. GRA

N76-24806# Innsbruck Univ. (Austria). Electronics Lab.

A NEW DEVICE FOR IN SITU MEASUREMENTS OF THE COMPLEX ROCK RESISTIVITY

Michael Oberladstaetter and Norbert Nessler 27 May 1975 28 p refs

(Contract F44620-72-C-0052)

(AD-A018883; Scientific-4; AFCRL-TR-75-0479) Avail: NTIS CSCL 08/7

A measuring device is described which permits the measurement of magnitude and phase of the complex rock resistivity with the well known Wenner array being applied. The apparatus is composed of the current generator, whose current of the rock and contact resistances to a large extent, the impedance transformers with extremely high-impedance inputs for potential measurements, and the electronic measuring equipment. The latter includes a special differential input amplifier with particularly high common-mode rejection even at high frequencies as well as filters in order to eliminate power supply ripple and HF intersperse. In a highly sensitive phase-sensitive detector the amplitude of the potential difference and the phase between potential difference and applied current are determined. The apparatus operates within 0.01 Hz and 10 kHz with an amplitude accuracy of 1 % and a phase resolution of 1% + or - 0.3 deg. Author (GRA)

N76-24807# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

MEASURING SOIL PROPERTIES IN VEHICLE MOBILITY RESEARCH. REPORT 7: BEHAVIOR OF FINE GRAINED SOILS UNDER HIGH-SPEED TIRE LOADS

Gerald W. Turnage Jun. 1975 70 p refs

(DA Proj. 4A0-61101-A-91D)

(AD-A012146; AEWES-TR-3-652-7) Avail: NTIS CSCL 08/13

This study examined the effects of wheel speed on the performance in fine-grained soils of single pneumatic tires, full-size wheeled vehicles, and a prototype aircraft under several tire operational modes. GRA

N76-24808# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

INVESTIGATION OF K(O) TESTING IN COHESIONLESS SOILS Final Report

Mosaid M. AlHussaini and Frank C. Townsend Dec. 1975 76 p refs

(DA Proj. 4A0-61101-A-91D)

(AD-A019503; WES-TR-s-75-16) Avail: NTIS CSCL 08/13

The ratio of horizontal to vertical effective stress when lateral yielding is prevented is known as the coefficient of earth pressure at rest and is denoted by the symbol K(o). K(o) values and the stress-strain response of soils under conditions of lateral restraint are important engineering quantities for problems involving settlement of large fills, lateral pressures on retaining structures, and yielding around excavations. In this report, four laboratory techniques and devices for experimentally determining K(o) values and the stress-strain relationships of Reid-Bedford sand are examined. These methods are: the linear variable displacement transducer (LVDT) clamp, the K(o) belt, swinging arms lateral strain sensors, and an indirect volume change method using a burette. The tests were conducted at three relative densities, 25, 75, and 100 percent, using modified triaxial compression chambers. GRA

N76-24809# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Science.

TECTONIC STRAIN RELEASE BY UNDERGROUND NUCLEAR EXPLOSIONS Final Report, 1 Oct. 1973 - 30 Jun. 1975

M. Nafi Toksoz 1 Sep. 1975 243 p refs

(Contract F19628-74-C-0072; AF Proj. 7639)

(AD-A019428; AFCRL-TR-75-0483) Avail: NTIS CSCL 08/11

Static and dynamic methods are developed to study the elastic field produced by earthquake faulting. An earthquake is considered as the slip on a planar fault due to frictional instability. The dynamics of a circular fault model is considered as a circular rupture front that expands subsonically from a nucleation point until it suddenly stops at its final radius. It was found that both the final slip on the fault and the rise time are zero on the edge of the fault and reach their maxima at the center of the fault. This slip-time history is quite different from that of the usual Haskell model where slip and rise time are assumed constant over the fault. The far field radiation due to this fault model was studied. A new method to compute the static near field of a shallow earthquake was developed. GRA

N76-24810# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
THEORY OF DEEP SITE STATIC CONE PENETRATION RESISTANCE Final Report
Mohsen M. Baligh Sep. 1975 145 p refs
(Grant NSF GK-42129)
(PB-248971/4; R75-56) Avail: NTIS CSCL 08M

The static cone penetration test combines simplicity, consistency and reliability in determining in situ soil properties during deep site investigation. The available methods of interpreting test results are summarized and the need for a better understanding of the penetration mechanism is emphasized. A theory for sharp cone penetration in clays is presented. The theory is based on dividing the work done during penetration into two parts: (1) the shearing due to penetration by cutting without volume change, and (2) the development of a cylindrical cavity to account for the volume of the pushing rods behind the cone. The clay deformation due to blunt pile penetration is also predicted and compared with experimental results.
Author (GRA)

N76-24811# Oklahoma State Univ., Stillwater. School of Civil Engineering.
IDENTIFICATION AND TREATMENT OF DISPERSIVE CLAY SOILS
T. Allan Haliburton, Thomas M. Petry, and Myron L. Hayden Jul. 1975 170 p refs
(Contract DI-14-06-D-7535)
(PB-248840/1) Avail: NTIS HC $6.75 CSCL 08M

Erosion damage caused by dispersive clay soil to natural cut slopes and artificial earth structures has, in recent years, become recognized as a serious problem neither predicted nor adequately defined by results of standard soils engineering tests. The availability of a reliable, before the fact, method for identification of potentially dispersive clay soil, plus a means for treatment of such material to improve its erosion resistance, would be a significant addition to the criteria used in design of earth structures and cut slopes. A study was undertaken to develop a method of physical testing for identification of potentially dispersive clay soil. In addition, the developed physical test was used to evaluate the effects of chemical treatment in reducing dispersive clay erosion potential. Hydrated lime, aluminum sulfate and sodium chloride were all found to be effective as chemical stabilizers to reduce dispersive clay erosion potential.
GRA

N76-24812# Joint Publications Research Service, Arlington, Va.
DETERMINING THE FORCE OF GRAVITY ON A MOBILE BASE WITH THE HELP OF HEAVILY DAMPED GRAVIMETERS
Ye. I. Popov, ed. 4 Jun. 1976 137 p Transl. into ENGLISH from the book "Opredeleniye Sily Tyazhesti na Podvizhnom Osnovanii s Pomoshchyu Silno Dempfirovannykh Gravimetrov" Moscow, 1967 p 5-8, 46-175
(JPRS-67408) Avail: NTIS

Heavily damped gravimeters are described and investigations of the elastic systems of gravimeters are reported. Author

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-24813 British Library Lending Div., Boston Spa (England).
MESOSCALE VARIATIONS OF WATER-CONTENT IN STRATIFORM CLOUDS
I. V. Litvinov [1974] 8 p refs Transl. into ENGLISH from Akad. Nauk, Doklady (Moscow), no. 219, 1974 p 1105-1107
(BLL-M-23854-(5828.4F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Measurements were carried out with the SIV-2 aircraft sonde. In addition to water content, measurements were made of air temperature and visual observation was used to register the presence or absence of precipitation. The measurements revealed that consecutive values of the water content within a group of observations sometimes vary considerably from one to the other. It is shown that there is a real variation in water content along a flight path passing through a cloud. J.M.S.

N76-24814 British Library Lending Div., Boston Spa (England).
THE WINTER LINK BETWEEN THE POLAR STRATOSPHERIC LOW AND THE CIRCULATION IN THE LOWER TROPOSPHERE
V. L. Arkhangelskiy [1974] 10 p refs Transl. into ENGLISH from Gidromet. Nauch-Issled. Tsentr. SSSR (Leningrad), vol. 128, 1974 p 100-103
(BLL-M-23864-(5828.4F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Data for the winter months (December-January) 1965-1969 are used to make a comparative analysis of cyclonic activity in the stratosphere and troposphere over the U.S.S.R., including the Soviet sector of the Arctic. Certain interconnections between the shapes of the polar stratospheric circulation over the U.S.S.R. and the depresssions and anticyclones near the earth's surface are examined. Author

N76-24815 British Library Lending Div., Boston Spa (England).
LONG-RANGE EXTRAPOLATION OF ANALOGUES
G. Koppany [1975] 26 p refs Transl. into ENGLISH from Orsz. Met., Szol., Idoej. (Budapest), no. 79, 1975 p 17-27
(BLL-M-23865-(5828.4F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

A method for making long range weather forecasts from previous weather statistics is presented. Monthly hemisphere temperature anomaly maps are used to select similarities in weather patterns from which future trends may be extrapolated. A.S.K.

N76-24816 British Library Lending Div., Boston Spa (England).
THE LINK BETWEEN STRATOSPHERIC GENESIS OF LOWS AND HIGHS AND PERIODIC FLUCTUATIONS IN THE GROWTH AND DECAY OF TROPOSPHERIC GEOPOTENTIAL IN ADVANCE OF COLD AND WARM MAYS
D. A. Drogaytsev [1974] 25 p refs Transl. into ENGLISH from Gidromet. Nauch.-Issled. Tsentr. SSSR.(Leningrad), v. 137, 1974 p 66-81 In ENGLISH and RUSSIAN
(BLL-M-23853-(5828.4F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The processes of interaction between the stratosphere and the troposphere are investigated. Examples from the past 10-12 years are examined in order to consider, for February and March, the link between stratospheric lows on the 30 mb surface and periodic falls in the H sub 500 geopotential taking place beneath them in advance of cold and wet Mays. The relationship between stratospheric highs and periodic rises in geopotential taking place in advance of warm and dry Mays is also examined.
Author

N76-24817 British Library Lending Div., Boston Spa (England).
RESULTS OF RESEARCH ON DEVELOPING A WAY OF FILLING OUT AND IMPROVING 3-MONTH METEOROLOGICAL FORECASTS
L. Yu. Ryzhakov [1975] 22 p refs Transl. into ENGLISH from Gidromet. Nauch. Issled. Tsentr. SSSR (Leningrad), v. 155, 1974 p 65-78

(BLL-M-24090-(5828.4F)) Avail: NTIS Avail: British Library Lending Div., Boston Spa, Engl.

A method for improving and filling-out the background forecast was developed for compiling meteorological forecasts for the polar region of the Northern Hemisphere with a leadtime of 10 months. L.S.

N76-24818 Deutscher Wetterdienst, Offenbach am Main (West Germany).

REPORTS FROM THE GERMAN METEOROLOGICAL SERVICE. VOLUME 18, NO. 137: SIX YEARS OF OZONE SOUNDINGS (1967-1972) AT THE METEOROLOGICAL OBSERVATORY HOHENPEISSENBERG. (A CONTRIBUTION TO THE CLIMATOLOGY OF THE FREE ATMOSPHERE) [BERICHTE DES DEUTSCHEN WETTERDIENSTES. BAND 18, NR. 137: 6 JAHRE (1967-1972) OZONSONDIERUNGEN AM METEOROLOGISCHEN OBSERVATORIUM HOHENPEISSENBERG (EIN BEITRAG ZUR KLIMATOLOGIE DER FREIEN ATMOSPHAERE)]

Walter Attmannspacher (Meteorol. Obs. Hohenpeissenberg, West Ger.) and Reinhold Hartmannsgruber 1975 42 p refs In GERMAN; ENGLISH summary

Avail: Issuing Activity

Balloon soundings of the atmospheric ozone, air temperature, and wind were made each Wednesday from 1967 to 1972. The sondes, receiving equipment, preparations before launch, and calculation of the data are described in brief. For the vertical range from 1 to 34 km the measured data have been statistically treated and represented as tables or figures. The results are described. Some suggestions of possible meteorological reasons and connections between the three measured parameters between ozone and solar activities, respectively, are given. Author (ESA)

N76-24819 Deutscher Wetterdienst, Offenbach am Main (West Germany).

REPORTS FROM THE GERMAN METEOROLOGICAL SERVICE. VOLUME 18, NO. 138: THE FREQUENCY SPECTRUM OF WIND DIRECTIONS FROM AN ECOLOGICAL POINT OF VIEW (PRESENTED FOR SPECIAL SITUATIONS IN RHEINGAU) [BERICHTE DES DEUTSCHEN WETTERDIENSTES. BAND 18, NR. 138: DAS HAEUFIGKEITSSPEKTRUM DER WINDRICHTUNGEN IN OEKOLOGISCHER SICHT (DARGESTELLT AN DEN BESONDEREN VERHAELTNISSEN IM RHEINGAU)]

Guenther Horney 1975 22 p refs In GERMAN; ENGLISH summary

Avail: Issuing Activity

The frequency of wind directions was examined in order to complement traditional climatological observations. Applying this frequency to vineyards, it is shown how a special treatment of the observations can help solve ecological problems. The results obtained may also be used for solving problems relating to the spread of air pollution. ESA

N76-24820*# Scientific Translation Service, Santa Barbara, Calif.

THE MAIN AGROMETEOROLOGICAL INERTIA FACTORS IN PRODUCING HARVESTS OF WINTER WHEAT IN THE CHERNOZEM ZONE AND A LONG-TERM FORECAST OF CROP CAPACITY

Ye. S. Ulanova Washington NASA Jun. 1976 23 p refs Transl. into ENGLISH from Tr. Gidrometeorologicheskogo Tsentra (Leningrad), no. 9, 1967 p 10-22

(Contract NASw-2791)

(NASA-TT-F-17038) Avail: NTIS HC $3.50 CSCL 04B

The basic agrometeorological inertia factors having the greatest influence on the crop capacity of winter wheat in the chernozem zone are considered. A method of making long term forecasts of its crop capacity is substantiated, in which forecasting dependencies are given for determining the harvest of winter wheat in the chernozem regions of the Ukraine, Moldavia and the Northern Caucasus. The role of weather in the spring-summer period is considered, and recommendations are given for making corrections in a crop capacity forecast formulated in spring. Author

N76-24821# World Meteorological Organization, Geneva (Switzerland).

UPPER-AIR SOUNDING STUDIES. VOLUME 1: STUDIES ON RADIOSONDE PERFORMANCE. VOLUME 2: MANUAL COMPUTATION OF RADIOWINDS

1975 172 p refs

(WMO-394; TN-140-Vol-1/2; ISBN-92-63-10394-1) Avail: NTIS HC $6.75; WMO, Geneva Sw. Fr. 15

Volume 1 is divided into three parts dealing with the assessment and factors involved in radiosonde compatibility: temperature reference sonde comparisons; and reference and national sonde comparisons. Volume 2 surveys the factors to be considered in selecting an appropriate practical system for computing upper-level winds. For individual titles, see N76-24822 through N76-24825.

N76-24822 World Meteorological Organization, Geneva (Switzerland).

RADIOSONDE COMPATIBILITY: ITS ASSESSMENT AND THE FACTORS INVOLVED

A. H. Hooper *In its* Upper Air Sounding Studies 1975 p 1-60 refs (For availability see N76-24821 15-47)

Copyright.

An analysis of the four types of radiosonde errors is made followed by a report on the results of laboratory work on sonde calibration stability and solar radiation effects. The merits and demerits of various comparison techniques with special reference sondes is discussed, together with the assessment of sonde quality in routine use. The state of the art with regard to reference pressure and humidity sensors is also presented. ESA

N76-24823 World Meteorological Organization, Geneva (Switzerland).

TEMPERATURE REFERENCE SONDE COMPARISONS

A. H. Hooper *In its* Upper Air Sounding Studies 1975 p 61-94 refs (For availability see N76-24821 15-47)

Copyright.

A description is given of the characteristics of the four temperature reference sondes of the FRG, Finland, Japan and the U.S.S.R. and the conduct of the series of comparisons at four locations from 1968 to 1973. A statistical analysis of the basic individual and the overall comparison data is presented. It is concluded that the need to reduce the variability of the data necessitates further work and that this might be accomplished by refining the comparison procedures. ESA

N76-24824 World Meteorological Organization, Geneva (Switzerland).

REFERENCE AND NATIONAL SONDE COMPARISONS

A. H. Hooper *In its* Upper Air Sounding Studies 1975 p 95-109 (For availability see N76-24821 15-47)

Copyright.

The comparison between the UK national sonde and the Finnish and Japanese reference sondes in 1972 at Bracknell is described followed by an analysis of the results in terms of temperature differences and of various factors affecting them of a limited number of twin-flight comparisons of the British and Finnish sondes. The possibility of using geopotential or pressure differences as alternative techniques of comparison for routine sondes is also discussed. ESA

N76-24825 World Meteorological Organization, Geneva (Switzerland).

MANUAL COMPUTATION OF RADIOWINDS

R. E. Vockeroth *In its* Upper Air Sounding Studies 1975 p 110-156 refs (For availability see N76-24821 15-47)

Copyright.

The factors to be considered in selecting an appropriate practical system for computing upper-level winds are reviewed. The use of vertical averaging intervals is discussed and a detailed error analysis is given for two typical wind computing systems. An assessment is also made of errors in computing vector winds by graphical and numerical methods. Suggestions as to techniques to be used for maintaining the performance of measuring and computing systems are made, with an example of computer-quality control analyses being provided. Regular evaluation of the accuracy of manual computations using computer procedures is recommended. ESA

N76-24826# World Meteorological Organization, Geneva (Switzerland).

APPLICATIONS OF SATELLITE DATA TO AERONAUTICAL METEOROLOGY

F. G. Finger, ed. and R. M. McInturff, ed. 1975 104 p refs (WMO-413; TN-142; ISBN-92-63-10413-1) Avail: NTIS HC $5.50; WMO, Geneva Sw. Fr. 32

The difficulties which have been experienced in providing an optimum network of upper-air stations to meet increasing requirements for meteorological information to serve aircraft operations at greater altitudes are described. Various types of meteorological satellites are illustrated and classified according to their orbital characteristics and purpose. The approach to applications of satellite data to aviation in the U.S.S.R., U.S.A. and other countries is discussed. For individual titles, see N76-24827 through N76-24828.

N76-24827 Hydrometeorological Service of the USSR.

THE APPROACH TO APPLICATIONS OF SATELLITE DATA IN THE USSR FOR AVIATION INTERESTS

K. G. Abramovich, G. S. Buldovskiy, A. A. Vasiliev, G. V. Vasilieva, N. V. Petrenko, G. D. Reshetov, and Y. P. Cherenkova *In* WMO Appl. of Satellite Data to Aeron. Meteorol. 1975 p 6-47 (For availability see N76-24826 15-47)

Copyright.

The use which is being made of satellite data in the detection of tropical cyclones and determination of their characteristics, in monitoring the evolution of cloud systems of fronts and cyclones in temperate latitudes, in the detection of zones of low stratus clouds and fog, in the determination of the position of the jet-stream axis as well as the utilization of satellite imagery by analyzing turbulence zones, is illustrated. ESA

N76-24828 National Oceanic and Atmospheric Administration, Hillcrest Heights, Md.

SOME APPLICATIONS OF SATELLITE DATA TO AERONAUTICAL OPERATIONS IN THE USA

R. M. McInturff and F. G. Finger *In* WMO Appl. of Satellite Data to Aeron. Meteorol. 1975 p 65-87 (For availability see N76-24826 15-47)

Copyright.

Information on the use of satellite data for flight documentation, in particular significant weather charts, for field service operations, for detection, classification and estimation of intensity of tropical storms is presented. The use of satellite radiometers for the operational determination of temperatures and geopotential heights is described, and plans for the future are summarized. ESA

N76-24829# World Meteorological Organization, Geneva (Switzerland).

THE ROLE OF METEOROLOGICAL SERVICES IN THE ECONOMIC DEVELOPMENT OF ASIA AND THE SOUTH-WEST PACIFIC

1975 188 p refs Proc. of the WMO/ECAFE Reg. Conf., Bangkok, 14-21 Aug. 1973

(WMO-422; ISBN-92-63-10422-0) Avail: NTIS HC $7.50; WMO, Geneva Sw. Fr. 26

The application of meteorology to a range of areas such as agriculture, land use, industry, natural disaster mitigator, is discussed. Cost/benefit studies of the impact of meteorological services on socio-economic development, together with the service structure and staff training requirements are described. In addition recommendations for action by WMO, ECAFE or Governments, as appropriate, are included. For individual titles, see N76-24830 through N76-24841.

N76-24830 Schweizerische Meteorologische Zentralanstalt, Zurich.

APPLICATION OF METEOROLOGY TO ECONOMIC AND SOCIAL DEVELOPMENT

R. Schneider *In* WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 14-30 refs (For availability see N76-24829 15-47)

Copyright.

Following a brief account of awareness and realization of the problem, United Nation's actions having implications for the development and future of meteorology are outlined. The fields of human activity in which meteorology plays a role are listed, and its contribution to economic development and protection of the environment is discussed. Studies to evaluate the profitability or benefits of efficient meteorological services are considered together with the organization and necessary facilities. ESA

N76-24831 National Oceanic and Atmospheric Administration, Columbia, Miss. Environmental Data Service.

APPLICATION OF METEOROLOGY TO LAND USE AND AGRICULTURE

James D. McQuigg *In* WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 31-38 refs (For availability see N76-24829 15-47)

Copyright.

Using a conceptual model, the ways in which the flow of meteorological information can contribute to economic development are illustrated. For specific applications the questions a national weather service attempting to have an impact on land use planning and agriculture should ask are outlined. ESA

N76-24832 Economic Social Commission for Asia and the Pacific, Bangkok (Thailand).

APPLICATION OF METEOROLOGY TO WATER RESOURCES DEVELOPMENT

In WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 39-50 (For availability see N76-24829 15-47)

Copyright.

The importance of climatological data pertaining to regional water resources projects, in particular to the river basins, is stressed. Problems in the design of water resources projects are described and the rainfall, flood, streamflow, drainage and other factors to be taken into account are discussed. The influence of the weather during the construction phase of a project is considered, followed by an account of the influence of weather during the operation of the project. Future requirements of hydraulic engineers in terms of meteorological information are outlined together with a brief note on national planning of meteorological services. ESA

N76-24833 New Zealand Meteorological Service, Wellington.

APPLICATION OF METEOROLOGY TO INDUSTRY

W. J. Maunder *In* WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 51-65 refs (For availability see N76-24829 15-47)

Copyright.

The effect of weather and climate on manufacturing and the choice of site is discussed together with a review of the sensitivity of certain segments of the manufacturing industry to the weather. The building and construction industry in New Zealand and the U.S.A. is briefly outlined and the economic impact of weather on planning and construction activities is described. ESA

N76-24834 United Nations Development Program. Typhoon Committee, Manila.

APPLICATION OF METEOROLOGY TO MITIGATION OF NATURAL DISASTERS

S. N. Sen *In* WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 66-79 (For availability see N76-24829 15-47)

Copyright.

Selected damage statistics of natural disasters of meteorological origin are presented followed by an outline of the climatological services necessary to alleviate such disasters. The requirements of efficient warning systems for flood predictions or cyclone approach are discussed. The modification of weather as a disaster mitigator is considered and the role which can be played by effective international cooperation is stressed. ESA

N76-24835 World Meteorological Organization, Geneva (Switzerland). Special Environmental Applications Div.

METEOROLOGY AND ECONOMIC DEVELOPMENT IN THE ECAFE REGION. PART 1: DEVELOPMENT OF METEOROLOGY IN THE ECAFE REGION

C. C. Wallen *In its* The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 80-84 (For availability see N76-24829 15-47)

Copyright.

The expenditure on the development of meteorology by

governments in the ECAFE region is discussed and compared to that of more developed countries. The impact and role of WMO assistance in the ECAFE region is described with examples taken from Thailand, Nepal and Mongolia. In addition mention is made of two regional projects - the Lower Mekong River Basin development and the regional typhoon program - benefiting the ECAFE region as a whole. ESA

N76-24836 Economic Social Commission for Asia and the Pacific, Bangkok (Thailand). Water Resources Section.
METEOROLOGY AND ECONOMIC DEVELOPMENT IN THE ECAFE REGION. PART 2: ECONOMIC DEVELOPMENT OF THE ECAFE REGION, 1961 - 1970
A. S. Manalac *In* WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 85-99 (For availability see N76-24829 15-47)
Copyright.

Following a review of some of the statistical parameters commonly used to measure and evaluate economic progress, information is presented on the growth of the total output of a number of countries in the ECAFE region for which statistics are available for the period 1961-70 and in the growth of the various economic sectors comprising this output. The effect of economic development on meteorological services is also discussed. ESA

N76-24837 World Meteorological Organization, Geneva (Switzerland). Special Environmental Applications Div.
COST/BENEFIT RELATIONSHIP STUDIES OF METEOROLOGICAL SERVICES
C. C. Wallen *In its* The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 100-109 (For availability see N76-24829 15-47)
Copyright.

The recent approach of the WMO to the development of methods for studies of cost/benefit in relation to meteorological services is discussed. Case studies in developed and developing countries will be carried out on the basis of a questionnaire. Conclusions drawn from some available cost/benefit studies are presented together with a model designed for agricultural problems. ESA

N76-24838 New Zealand Meteorological Service, Wellington.
METEOROLOGY IN RELATION TO NATIONAL ECONOMIC DEVELOPMENT PLANS
W. J. Maunder *In* WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 110-130 refs (For availability see N76-24829 15-47)
Copyright.

Three important concepts which have resulted in a greater need for atmospheric information are summarized, followed by an assessment of the value of such weather information especially for weather-sensitive activities. The problems of measuring economic losses as a result of weather variations are outlined and the possibility of alleviating these by the modification of weather is considered. ESA

N76-24839 Institut Royal Meteorologique de Belgique, Brussels.
SOCIO-ECONOMIC FEATURES OF WMO REGIONS 2 AND 5 JUSTIFYING THE EXPANSION OF METEOROLOGICAL SERVICES IN LESS DEVELOPED COUNTRIES
E. A. Bernard *In* WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 131-143 refs (For availability see N76-24829 15-47)
Copyright.

Socio-economic features such as population, GNP and agriculture in developing countries in the Pacific region are discussed. The importance of meteorological services and their development as an aid to alleviating the seriousness of demographic problems is stressed. ESA

N76-24840 Institut Royal Meteorologique de Belgique, Brussels.
STRUCTURE AND DIMENSION OF METEOROLOGICAL SERVICES FOR THE REQUIREMENTS OF SOCIAL AND ECONOMIC DEVELOPMENT
E. A. Bernard *In* WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 144-164 refs (For availability see N76-24829 15-47)

The structural requirements for a national meteorological service are discussed. These include the rank and status that the service should occupy in the State administrative hierarchy; the internal organization of the service in relation to its activites; and the cooperation with other bodies on a national or international level. An analysis of the contribution of meteorological activites to the GNP is made and the determination of an optimum budget for a meteorological service is outlined. The requirements for meteorologists are also considered. ESA

N76-24841 Schweizerische Meteorologische Zentralanstalt. Zurich.
EDUCATION AND TRAINING OF PERSONNEL IN THE APPLICATIONS OF METEOROLOGY TO ECONOMIC DEVELOPMENT
R. Schneider *In* WMO The Role of Meteorol. Serv. in the Econ. Develop. of Asia and the South-West Pacific 1975 p 165-167 (For availability see N76-24829 15-47)
Copyright.

The importance of education and training in the applications of meteorology to economic development is stressed, and the role that can be played by an effective public relations office is discussed. Courses and syllabi for the training of meteorologists are outlined. ESA

N76-24842# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
RAIN SCAVENGING STUDIES Progress Report
A. N. Dingle May 1975 85 p refs
(Contract AT(11-1)-1407)
(COO-1407-58; PR-11) Avail: NTIS HC $6.00

The modeling of convective storm scavenging processes is developed on two distinct fronts. The first of these relates to the microphysical processes, particularly to the study of their response to micro-dynamical components of the convective circulation. It is found that the droplet size spectra generated are responsive to variations of vertical velocity due to turbulence within the cloud and to humidity variations due to entrainment processes. Both sets of variations give responses that differ for different amplitudes and frequencies, i.e., rapid, small-amplitude eddies appear to enhance small-droplet development, whereas slow, large-amplitude oscillations tend to enhance large-droplet development. The second modeling effort is addressed to the problem of three-dimensional representation of convective dynamics. Equations are presented, and some of the problems under attack are discussed. Author (ERA)

N76-24843# Kernforschungszentrum, Karlsruhe (West Germany).
METEOROLOGICAL DATA ACQUISITION SYSTEM. FUNCTIONAL DESCRIPTION AND GENERAL CHARACTERISTICS OF THE DIFFERENT COMPONENTS
S. Bouharrour and P. Thomas Jul. 1975 157 p refs In GERMAN
(KFK-2181) Avail: ERDA Depository Libraries HC $7.75

The 200 m meteorological tower of the Karlsruhe Nuclear Research Center was equipped with 45 instruments measuring the meteorological parameters near the ground level. Frequent inquiry of the instruments implies data acquisition with on-line data reduction. This task is fulfilled by some peripheral units controlled by a PDP-8/I. This report presents details of the hardware configuration and a short description of the software configuration of the meteorological data acquisition system. The report also serves as an instruction for maintenance and repair work to be carried out at the system. Author (ERA)

N76-24844# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
SAMPLING OF DROPLET DISTRIBUTIONS FROM WATER CLOUDS
Klaus-Peter Schickel 25 Nov. 1975 179 p refs
(DLR-Mitt-75-25) Avail: NTIS HC $7.50; DFVLR, Cologne DM 55,80

A total of 1980 droplet distributions of water clouds are sampled from the literature from 56 publications. They are made compatible for input into digital computers. A number of model distributions is in preparation based on these data. The data collection is publicly available. Author (ESA)

N76-24845# Stockholm Univ. (Sweden). Inst. of Meteorology.

ON PARAMETERIZATION OF CONVECTION FOR LARGE SCALE NUMERICAL FORECASTS AT MIDLATITUDES

Ulla Hammarstrand Dec. 1975 47 p refs

(Contract G-223-58)

(DM-18) Avail: NTIS HC $4.00

Two methods for parameterizing convection were used in making forecasts with a large scale primitive equation model for the Northern Hemisphere. The forecast precipitation, pressure and temperature were compared to values from a forecast where the effects of convection have not been included. The first parameterization scheme used is the one usually called penetrative convection, which produces precipitation-patterns that seem to agree well with the observed precipitation, while the precipitation produced by the other scheme, moist convective adjustment, shows large differences as compared to observations. Results from experiments, in which some adjustable parameters in the two schemes were varied have also been analyzed. Finally considerations are presented regarding the possibility to express the forecast precipitation in terms of probabilities for precipitation at a point within the area of convection. Author (ESA)

N76-24846# World Meteorological Organization, Geneva (Switzerland).

MULCHING EFFECTS ON PLANT CLIMATE AND YIELD

J. W. Davies 1975 103 p refs

(WMO-388; TN-136; ISBN-92-63-10388-7) Avail: NTIS HC $5.50; WMO, Geneva Sw.Fr. 20

The effects of mulching - the covering of the soil surface with crop residue or other material such as paper or plastic - on temperature, soil moisture, erosion and soil physics, pests and diseases, growth and yield of plants, and weed suppression are reviewed for different types of crop including temperate fruit trees, vegetables and flowers, forestry, grasses and cereals and tropical and subtropical crops. Extensive references to the literature are provided. ESA

N76-24847# World Meteorological Organization, Geneva (Switzerland).

ECONOMIC BENEFITS OF CLIMATOLOGICAL SERVICES

R. Berggren 1975 57 p refs Presented at the 6th Session of the Comm. for Special Appl. of Meteorol. and Climatol., Bad Homburg, West Ger., 1973

(WMO-424; TN-145; ISBN-92-63-10424-7) Avail: NTIS HC $4.50; WMO, Geneva Sw.Fr. 15

The difference between the economic value of information based on synoptic forecasts and climatological studies is considered. The economic benefits of climatological services are discussed with examples taken from different sectors of society, for example: land use and town planning, agriculture and forestry, building design, transportation, water supplies, recreation, and health. A comprehensive list of references is also given. ESA

N76-24848# World Meteorological Organization, Geneva (Switzerland).

REPORT ON THE FIELD PHASE OF THE GARP ATLANTIC TROPICAL EXPERIMENT OPERATIONS

Oct. 1975 160 p Prepared jointly with ICSU, Rome

(GATE-15) Avail: NTIS HC $6.75; WMO Geneva

The management structure and coordination for GATE is outlined together with the daily operational procedures at the GOCC. The operation of observing platforms, distribution of ships, aircraft participation and geostationary and polar-orbiting satellites - and land stations is discussed and an intercomparison of ship and aircraft observing systems summarized. The communication schemes for the GOCC, ships, and aircraft are described together with the data transmission facilities. Operational conclusions and recommendations are presented. ESA

N76-24849# World Meteorological Organization, Geneva (Switzerland).

REPORT OF THE SECOND SESSION OF WMO EXECUTIVE COMMITTEE INTER-GOVERNMENTAL PANEL ON THE FIRST GARP GLOBAL EXPERIMENT

1975 95 p Conf. held at Geneva, Sep. 1975 Prepared jointly with ICSU, Rome

(GARP-Spec-Rept-17) Avail: NTIS HC $5.00; WMO, Geneva

The organization of the session is briefly outlined followed by a discussion of the FGGE observing system and the data management system. The various oceanographic programs and related experiments are outlined together with planning associated with the experiment and future activities. ESA

N76-24850# World Meteorological Organization, Geneva (Switzerland).

REPORT OF THE ELEVENTH SESSION OF THE JOINT ORGANIZING COMMITTEE Global Atmospheric Research Program

1975 242 p refs Conf. held at Tokyo, 1-8 Oct. 1975 Prepared jointly with ICSU, Rome

Avail: NTIS HC $8.00; WMO, Geneva

Following brief details on the organization of the session, the FGGE and its components are discussed. The GARP climatic dynamics, numerical experimentation, and the subprograms are reviewed and projects related to GARP are described. The organization of future work is also outlined. ESA

N76-24851# Bonn Univ. (West Germany). Inst. fuer Meteorologie.

ENERGETICS OF SYNOPTIC COLD CORE DISTURBANCES IN THE TROPICAL ATMOSPHERE Ph.D. Thesis

Klaus Fraedrich Ferd. Duemmler's Verlag 1974 69 p refs In GERMAN; ENGLISH summary

(Bonn-Mi-20-1974; ISBN-3-427-75801-x-1) Avail: NTIS HC $4.50; Ferd. Duemmler's Verlag DM 22

Nine disturbances (cold lows) in the tropical atmosphere which exist for two days in the Caribbean network are separately assembled in relative coordinates with respect to a meridional cloud axis (defined by satellite), the thickness along the cloud axis, and an accordeon scale to normalize the wavelength. The analysis is confined to the 850 and 200 mb levels. The wind, divergence, thickness and cloud fields are constructed including the time development. They reveal a conserved dipole-like pattern of synoptic scale upward and downward motion. The descending area is cloudfree and heated by adiabatic compression, the column with ascending air is identical with the cloud area and there is no thickness change. The rainfall rate and the large scale ascent can be derived for the cloud column. A scale analysis shows that the energy source for tropical disturbances is the release of latent heat which occurs in cumulonimbi. A new technique is developed to describe how these mesoscale processes interact with the synoptic scale and feed energy and momentum (vorticity) into the environment. This leads to the synoptic scale sources of heat, moisture, and voriticity due to the convective processes of lateral mixing and compensating subsidence. This interaction model, assuming some simplifications is applied (1) to the cloud ensemble embedded in the synoptic scale column of ascending motion and (2) to mesoscale data of a cumulonimbus element. The determination of cloud properties (e.g. condensation rate, temperature, moisture, vorticity and moisture (heat) convergence and storage, etc.) and the related large scale sources indicate a good agreement with the observations. Author (ESA)

N76-24852# Bonn Univ. (West Germany). Inst. fuer Meteorologie.

NUMERICAL CALCULATION OF THE RADIATION BALANCE AND RADIATION HEATING OF THE ATMOSPHERE IN THE MERIDIONAL VERTICAL CROSS SECTION Thesis [EINE NUMERISCHE BERECHNUNG DER STRAHLUNGSBILANZ UND DIE STRAHLUNGSERWAERMUNG DER ATMOSPHAERE IM MERIDIONAL-VERTIKALSCHNITT]

Wolfgang Peyinghaus Ferd. Duemmler's Verlag 1974 66 p refs In GERMAN

(Bonn-Mi-22-1974; ISBN-3-427-75821-4) Avail: NTIS HC $4.50; Ferd. Duemmler's Verlag DM 22

A model was developed for calculating the vertical profile of the radiation balance based on the radiation transfer equations in the long wave spectrum (3.1 to 500 micron), and the exponential Bougner-Lambert attenuation law in the solar spectrum (0.3 to 8 micron). Their divergence produces the temperature variation of the atmosphere caused by radiation. Two points are accentuated: (1) the parameters affecting radiation (H_2O, CO_2, O_3, mist, albedo, clouds) explicitly remain in the

equations, no parameterization is used; (2) a concrete field of application is climatological calculation. ESA

N76-24853# Naval Weapons Center, China Lake, Calif. Research Dept.
ELECTROSTATIC INDUCTION PARAMETERS TO ATTAIN MAXIMUM SPRAY CHARGE TO CLEAR FOG Technical Publication, Jul. - Nov. 1974
John W. Carroz and Patrick N. Keller Jan. 1976 33 p refs
(AD-A019483; NWC-TP-5796) Avail: NTIS CSCL 04/2

Laboratory experiments using sprays of charged drops were conducted to support a fog clearing program. Sprays from 1-g/s hollow-cone industrial spray nozzles were induction-charged to one-quarter of the Rayleigh charged drop stability limit. As the nozzle size was increased, a smaller fraction of the Rayleigh stability limit was achieved. Increasing the airflow past the nozzle increased the charge on the spray. Increasing induction surface, fluid conductivity, and voltage increased the spray charge to a limit beyond which further increases decreased the spray charge. Increasing the fluid pressure increased the total spray current but not the charge-to-mass ratio. The laboratory data agree with a qualitative derivation relating drop charge to the nozzle spray geometry. The derivation shows that the greatest charge-to-mass ratio will be achieved with narrow-cone-angle nozzles. GRA

N76-24854# Aeronautical Research Associates of Princeton, Inc., N.J.
DEVELOPMENT OF A LOW-LEVEL ATMOSPHERIC TURBULENCE MODEL FOR MARINE ENVIRONMENTS Final Report, 4 Sep. 1974 - 4 Sep. 1975
W. S. Lewellen and M. E. Teske Sep. 1975 63 p refs
(Contract N00019-75-C-0154)
(AD-A018374; ARAP-255) Avail: NTIS CSCL 04/2

Second-order closure modeling of turbulence is used to develop a program for computing the marine atmospheric boundary layer. Detailed low-level distributions of mean velocity, temperature, humidity, and the second-order correlations of the turbulent fluctuations of these variables, are computed numerically from a set of partial differential equations for these variables. Moisture is permitted in both gaseous and liquid form with the change of phase assumed to follow equilibrium, Clasius-Clapeyron conditions. Comparison with laboratory data and qualitative comparison with field observations tend to verify the program's predictions. The predictions for humidity and temperature, along with their fluctuations, are used to predict the index of refraction and the refractive-index-structure parameter. Several sample calculations are made. These include calculations using (a) output from the hemispherical model of Fleet Numerical Weather Central, (b) boundary conditions corresponding to the Atlantic Tradewinds, and (c) conditions simulating steady shoreline situations for different combinations of land and water temperature. GRA

N76-24855# Mitre Corp., Bedford, Mass.
METEOROLOGICAL DATA BASE FOR 1974 AWACS-SID
B. N. Charles Oct. 1975 87 p refs
(Contract F19628-75-C-0001; AF Proj. 4110)
(AD-A018466; MTR-2990; ESD-TR-75-90) Avail: NTIS CSCL 04/2

Routine and special meteorological observations together with airborne refractometer observations were acquired as an improved weather data base for post-analyses of propagation during selected days of the 1974 AWACS SID. This paper describes these data and the methods used to derive detailed refractivity cross-sections for entry into a two-dimensional ray-tracing simulation. Author (GRA)

N76-24856# Ultrasystems, Inc., Irvine, Calif.
TWO-DIMENSIONAL HEAT PLUMES FOR FOG DISPERSAL Final Report, 1 Jul. 1973 - 30 Jun. 1975
F. Charles Price and Thomas J. Tyson Hanscom AFB, Mass. AFCRL 30 Jun. 1975 112 p refs
(Contract F19628-74-C-0024; AF Proj. 7605)
(AD-A018658; JN-8270; AFCRL-TR-75-0421) Avail: NTIS CSCL 04/2

A facility was created and operated to study in clear air, 1/3 to 1/12 full size, the nature of two-dimensional momentum driven warm plumes over a runway. Twenty-four, one-horsepower, gasoline-driven blowers were used in combination with evaporative propane burners. A 100 ft long paved 'runway', 50 ft wide, bounded on each end by curtains 30 ft high by 100 ft long perpendicular to the runway, was installed for this study of the crosswind case. The cases of sources placed upwind and/or downwind of the runway were studied. This report covers system design and operation, math modeling, and applications engineering of a portion of the results. Instrumentation, data reduction and comprehensive reporting of results were the responsibility of AFCRL. Tests were also run in a micrometeorological tunnel at 1/50 and 1/72 scale. The scaling law involving the ratio of buoyancy to momentum, proved to work when constant Delta T was run at various scale sizes. The most efficient system appeared to be the use of one row on each side of the runway, as close to the runway as possible, with the downwind row furnishing most of the momentum and heat to the runway region. Author (GRA)

N76-24857# Army Electronics Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
ATMOSPHERIC STRUCTURE WHITE SANDS MISSILE RANGE, NEW MEXICO. PART 3: UPPER AIR AND SURFACE DATA, WHITE SANDS DESERT SITE
Marjorie M. Holidale, Michael P. Dayton, and Lamar Newman Jul. 1975 234 p refs
(DA Proj. 1T6-65702-D-127)
(AD-A018434; DR-89216-Pt-3) Avail: NTIS CSCL 04/2

A statistical analysis of surface and upper air rawinsonde data is presented for White Sands Desert Site, White Sands Missile Range, New Mexico. Atmospheric parameters covered for the layer from the surface to 100,000 feet above mean sea level are: wind, temperature, pressure, density, moisture, index of refraction and freezing level. Upper air climatological information is based on the period of observation from 1961-1973: while surface temperature data spans 1960-1973; precipitation records 1963-1973, and wind data 1966-1973. GRA

N76-24858# Corps of Engineers, Baltimore, Md.
IMPACT OF TROPICAL STORM AGNES ON CHESAPEAKE BAY. VOLUME 1: SUMMARY Final Report
Mar. 1975 81 p
(AD-A019426; CHB-003-S) Avail: NTIS CSCL 04/2

The report summarizes the long-term impact Tropical Storm Agnes had on the Chesapeake Bay Region. The June 1972 storm caused severe lowerings of salinity levels in the Bay, which resulted in high mortalities of immobile estuarine and marine species. Mobile species were less affected. The floodwaters carried large amounts of nutrients and sewage into the Bay, thereby creating a public health hazard. The major geological effect was the deposition of sediment. Storm-related economic costs on the Bay Region totaled $42.7 million. Immediate costs were damages to boats and the clearing of debris. Long-term economic losses occurred to the recreation and fisheries industry. GRA

N76-24859# Corps of Engineers, Baltimore, Md.
IMPACT OF TROPICAL STORM AGNES ON CHESAPEAKE BAY. VOLUME 2: APPENDIX Final Report
Mar. 1975 665 p refs
(AD-A019425; CHB-003-A-Vol-2) Avail: NTIS CSCL 04/2

Contents: The effects of Tropical Storm Agnes on the Chesapeake Bay estuarine system (Hydrological effects, Geological effects, Water quality effects, Biological effects, Economic impacts. Public health impacts). GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography: and marine resources.

N76-24860 British Library Lending Div., Boston Spa (England).
THEORY OF THE MAIN THERMOCLINE (A REVIEW)
P. S. Lineykin [1974] 27 p refs Transl. into ENGLISH from Okeanologiya (Moscow), no. 14, 1974 p 965-981
(BLL-M-23835-(5828.4F)) Avail: British Library Lending Div.,

Boston Spa, Engl.: 3 BLL photocopy coupons

Literature on the linear and nonlinear theory of the thermocline is reviewed, and a new formulation of the boundary value problem in the dynamics of the thermocline is proposed, together with an approximate solution. Consideration is given to generalization of the classical Stommel problem for the case when basin depth, density flux, and tangential wind stress vary only along the meridian. It turns out that meridional transport of water under conditions simulating the subtropical zone of the North Atlantic is two to two and a half times as great as the corresponding value for a horizontal bed and two and a half to five times as great as the meridional transport in a barotropic ocean with the same bed inclination. Estimates are given for the thickness of the boundary layers near the shore. Author

N76-24861*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TRANSFORMATION OF APPARENT OCEAN WAVE SPECTRA OBSERVED FROM AN AIRCRAFT SENSOR PLATFORM

Lamont R. Poole Washington Jun. 1976 23 p refs
(NASA-TN-D-8246; L-10802) Avail: NTIS HC $3.50 CSCL 08C

The problem considered was transformation of a unidirectional apparent ocean wave spectrum observed from an aircraft sensor platform into the true spectrum that would be observed from a stationary platform. Spectral transformation equations were developed in terms of the linear wave dispersion relationship and the wave group speed. An iterative solution to the equations was outlined and used to transform reference theoretical apparent spectra for several assumed values of average water depth. Results show that changing the average water depth leads to a redistribution of energy density among the various frequency bands of the transformed spectrum. This redistribution is most severe when much of the energy density is expected, a priori, to reside at relatively low true frequencies. Author

N76-24862# Naval Postgraduate School, Monterey, Calif.

APPARENT SURFACE CURRENTS OVER THE MONTEREY SUBMARINE CANYON MEASURED BY THE METHOD OF TOWED ELECTRODES M.S. Thesis

Karl Arthur Mahumed Sep. 1975 83 p refs
(AD-A018298) Avail: NTIS CSCL 08/3

Five data cruises were taken on board R/V ACANIA to study the effect on the Geomagnetic Electrokinetograph (GEK) of various environmental factors, including wings, tides, and internal waves, over the Monterey Submarine Canyon. An in situ current meter was used successfully on one occasion to obtain data to establish a k-factor for the GEK in the Submarine Canyon, and to directly measure the particle velocities of internal waves. The observed surface currents measured with the GEK all exhibited little or no correlation with winds and tides. The flows were all generally southerly; their averages agreed with previous measurements made with the GEK. This direction of flow was opposite to the generalizations of Scott and possibly agreed with those of Pirie, depending upon the placement of one of his eddies. The k-factor for the GEK could not be determined because currents measured directly in the thermocline were found to be not correlated with the GEK measurements. However, the average current speeds were in reasonable agreement with currents measured at other times in Monterey Bay, leading to the conclusion that k cannot be much greater than the assumed value of 1.0. Author (GRA)

N76-24863# Naval Postgraduate School, Monterey, Calif.

CURRENTS IN MONTEREY SUBMARINE CANYON M.S. Thesis

John Edward Hollister Sep. 1975 86 p refs
(AD-A018327) Avail: NTIS CSCL 08/3

Time series were obtained from two current meters near bottom on one mooring in Monterey Submarine Canyon. These records were analyzed to determine the general character of the currents, the volume transport at different levels above the canyon floor, the power spectral estimates of the up-canyon and cross-canyon directional components, and the coherence between directional components. Current speed variations appeared as a series of peaks occurring every 5 to 6 hr with maxima of 17 to 21 cm/sec. Current directions oscillated with a discernible period of about 12 hr. Currents 30 m above the bottom were aligned nearly along the canyon axis; currents 60 m above the bottom were nearly perpendicular to the canyon axis. The spectral analysis indicated tides as a major driving force of the deep currents, but also indicated the presence of other forcing functions, possibly internal waves, with shorter periods. The coherence between instruments was low, suggesting the possible presence of a near-bottom boundary layer, or that significant signal deterioration was caused by noise. Author

N76-24864# Coastal Engineering Research Center, Fort Belvoir, Va.

SURF OBSERVATIONS AND LONGSHORE CURRENT PREDICTION

James H. Balsillie Nov. 1975 42 p refs
(AD-A019512; CERC-TM-58) Avail: NTIS CSCL 08/3

Simultaneous field observations of breaker and current behavior have been made using techniques of the Littoral Environment Observation (LEO) program. This program, developed at CERC, is used to collect data on beach and surf conditions. The data base for this report represents a concentrated data collection effort over a period of 1 year at three beach sites at Point Mugu, California. Longshore current behavior is investigated in two ways: (a) Observed and (b) predicted, using LEO data. Observed longshore currents are represented by the behavior of dye injected into the surf between the shoreline and breakers. Predicted longshore currents, based on the observation that longshore currents are generated primarily by waves, are estimated using a relationship for the average longshore current across the surf. The prediction model relies upon consideration of the radiation stress or wave thrust on water inside the breakers, and is evaluated using LEO breaker heights, angles of wave approach at breaking, and estimated widths of the surf zone. The degree of similarity between observed and predicted longshore currents is significantly high. This similarity not only suggests that the relationship for prediction of longshore currents is reasonable in field situtations, but that there is a surprising degree of internal consistency within typical LEO data sets. GRA

N76-24865# Washington Univ., Seattle. Applied Physics Lab

MARGINAL SEA ICE ZONE OCEANOGRAPHIC MEASUREMENTS, BERING AND CHUKCHI SEAS, 1973 AND 1974

G. R. Garrison and P. Becker 22 Sep. 1975 161 p refs
(Contract N00123-74-C-2064; ZF5255501)
(AD-A018763; APL-UW-7505) Avail: NTIS CSCL 08/10

Oceanographic surveys were conducted in the Bering Sea, the Bering Strait and the Chukchi Sea to study the summer intrusion of warm water into the Chukchi Sea. The northward movement of warmed Bering Sea water starts early in July and enters the Chukchi Sea in two areas: A narrow current along the coast which normally proceeds past Barrow, and a broad flow northward which passes to the east of Wrangel Island and gradually spreads into a thick surface layer across the Chukchi Sea. The zone of contact between intrusion and existing arctic water contains the thermal microstructure that is such a problem to the acoustician. The intrusion appears to stop in September as the surface-cooled waters begin to spread southward. Thermal microstructure also appears near Barrow in the spring as the deeper Atlantic water rises and partially mixes with the colder arctic water. GRA

N76-24866# Texas Univ., Austin. Applied Research Labs.

ACOUSTICAL AND ENGINEERING PROPERTIES OF SEDIMENTS Final Report, 1 Oct. 1973 - 31 Oct. 1975

Donald J. Shirley 29 Oct. 1975 69 p refs
(Contract N00014-70-A-0166; NR Proj. 083-306)
(AD-A018629; ARL-TR-75-58) Avail: NTIS CSCL 08/10

As part of a program of in situ acoustical measurements in ocean sediments, an experimental investigation was started in order to examine the feasibility of measuring shear wave speed, shear wave attenuation, and bulk density by using instruments similar to the compressional wave profilometer developed previously. Measurements were made of the shear wave speed and attenuation in high porosity koalinite clay as the clay consolidated over a period of time. Experimental and theoretical investigation of the measurement of bulk density by acoustical means indicates that the radiation impedance of a driven

piezoelectric ceramic transducer can be determined by measuring the electrical input to the transducer. Preliminary measurements of these parameters are reported. As an adjunct to the other measurements, physical properties of the sediments used in the laboratory measurements were determined and are reported. GRA

N76-24867# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.

ANALYTIC EQUATION OF STATE FOR SEA WATER

F. H. Fisher, Robert Bruce Williams, and O. E. Dial, Jr. 1 Dec. 1975 17 p refs

(Contract N00014-69-A-0200-6002; NR Proj. 260-103)

(AD-A019504; SIO-Ref-75-30; MPL-U-99.1/67) Avail: NTIS CSCL 08/10

Earlier work by Fisher and Dial on pure water and sea water showed the effectiveness of the Tumlirz equation, in representing the precision pure water data of Kell and Whalley from 0 to 150 degrees up to 1,000 bars. In addition it was also shown that a modified Tumlirz equation could be used to represent the sea water data of Wilson and Bradley. In this paper the thermal expansion data of Bradshaw and Schleicher and the sound velocity data of Wilson have been incorporated to yield a new equation of state for sea water. GRA

N76-24868# Coast Guard, Washington, D.C. Oceanographic Unit.

TEST RESULTS OF THE PLESSEY MODEL 9040 S/T/D ENVIRONMENTAL PROFILING SYSTEM

May 1975 22 p refs

(AD-A018723; CGOU-TR-3) Avail: NTIS CSCL 08/10

During January 1972, 17 STD casts were taken under controlled conditions using Plessey's Model 9040 S/T/D Environmental Profiling System (STD) in an attempt to determine how the temperature and/or salinity corrections vary with depth. The data indicated that the differences between the quality control salinity values and the salinity values obtained from the STD system varies by less than 0.02 ppt from the surface down to 3,000 meters. However, this correction value was offset from zero by about 0.05 ppt. The temperature correction varied considerably with depth, (about 0.07 C), these variations being outside of the manufacturer's specifications. After applying a correction published by the manufacturer, differences between actual depth and recorded depth were generally within instrument accuracy. GRA

N76-24869# Coast Guard, Washington, D.C.

COAST GUARD OCEANOGRAPHIC UNIT DDP-516 PROGRAMS

A. S. Hislop Jun. 1973 34 p

(AD-A018724; CGOU-73-2) Avail: NTIS CSCL 08/10

The DDP-516 OCEANOGRAPHIC PROGRAMS were written to aid in the reduction of data both on ships equipped with a DDP-516 and at the U.S. Coast Guard Oceanographic Unit. These programs may be used for real-time data reduction or as a check on previously processed data. Author (GRA)

N76-24870# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.

FLORIDA CURRENT ENERGETICS STUDY: FRONTAL ZONE OBSERVATIONS

Thomas B. Curtin, Thomas N. Lee, and Christopher N. K. Mooers Oct. 1975 153 p refs

(Contract N00014-75-C-0173-8918; Grant NOAA-N22-102-72(G))

(AD-A018902; UM-RSMAS-75044) Avail: NTIS CSCL 08/3

The objectives of the data report are to provide documentation and graphic illustration of the total accumulated data set acquired during an investigation of the vertical structure of the frontal zone on the cyclonic side of the Florida Current. Beyond error evaluation and contoured fields, no interpretation of the data is provided. The report is intended to serve as a convenient manual for making decisions on selective data analyses from the complete data set. The report includes data from a series of cruises of the R/V VIRGINIA KEY during March and April, 1974. These cruises constituted part of the Florida Current energetics study and the frontal spin-off eddy observational program. GRA

N76-24871# Naval Research Lab., Washington, D.C. Advanced Space Sensors Applications Branch.

AN INVESTIGATION OF THE REMOTE DETERMINATION OF SEA SURFACE TEMPERATURE USING MICROWAVE RADIOMETRY Interim Report

James P. Hollinger, Robert M. Lerner, and MacMillan M. Wisler Nov. 1975 56 p refs

(NRL Proj. G01-10; WF52551702)

(AD-A018771; NRL-MR-3159) Avail: NTIS CSCL 08/3

This is an interim report on an ongoing program to develop a passive microwave system for the remote all-weather measurement of sea surface temperature from a satellite platform. It presents the results of a theoretical investigation of the interdependence of the relevant environmental and instrumental parameters and their effect on the measured microwave brightness temperature and the sea surface temperature derived from it. The parameters considered are sea surface temperature, sea salinity, ocean roughness (wind speed), atmospheric water vapor, clouds, and the observational frequency. Detailed descriptions of the calculations of the emission and reflection of the sea surface, the emission and absorption of the atmosphere, the translation and rotation of the antenna properties from the satellite-oriented coordinate system to an earth-oriented system, and the convolution of the antenna reception pattern with the total radiation over the earth's surface are given. Calculations of the microwave brightness temperature and of the uncertainty of the sea surface temperature derived from it for a range of values and uncertainties of the environmental conditions are presented. These calculations indicate that the optimum observational frequency for the determination of sea surface temperature lies between about 3 and 6 GHz. The dominant source of error is due to uncertainty in the effects of ocean roughness. A multifrequency microwave system will be required to correct for the effects of the various environmental factors and to obtain the sea surface temperature to an uncertainty of less than 1 C. GRA

N76-24872# Naval Postgraduate School, Monterey, Calif.

A COMPARISON OF SATELLITE IMAGES CAPABLE OF DETECTING OCEAN SURFACE FEATURES M.S. Thesis

Bruce William Platz, Jr. Sep. 1975 91 p refs

(AD-A019380) Avail: NTIS CSCL 08/3

This study compares the capabilities of the images obtained from the archives for the satellites of National Oceanic and Atmospheric Administration (NOAA), Defense Meteorological Satellite Program (DMSP), and Earth Resources Technology Satellite (ERTS) systems for displaying information about oceanic currents and circulation features. GRA

N76-24873# National Oceanic and Atmospheric Administration, Rockville, Md.

RESULTS OF A SURVEY OF STATE COASTAL ZONE MANAGEMENT PROGRAM INFORMATION NEEDS

Oct. 1975 37 p refs

(PB-249595/0; NOAA-76011506) Avail: NTIS HC $4.00 CSCL 13B

A survey of all state and territory coastal zone management programs was conducted in July and August 1975 to assess (1) FY 76 state program assistance needs, (2) the usefulness of past OCZM technical assistance efforts, and (3) their long term technical assistance needs. States and territories were asked to rank order candidate topics in various categories. The results of the survey are presented along with detailed comments states made on each topic and a copy of the survey form. GRA

N76-24874# National Oceanic and Atmospheric Administration, Rockville, Md.

STATE COASTAL ZONE MANAGEMENT ACTIVITIES 1974

Oct. 1974 128 p refs

(PB-249753/5; NOAA-76011503) Avail: NTIS HC $6.00 CSCL 13B

In 1974 alone, more than $12,000,000 in federal and state funds have been committed to state coastal zone management efforts. Moreover, 31 of the 34 coastal states and territories are participating in the coastal zone management program. Each state's coastal zone management activities are analyzed. This information should enable a comparative analysis to be made of the differing approaches taken by the states. GRA

N76-24875# George Washington Univ., Washington, D.C.
METHOD OF CONTROL OF LAND AND WATER USES IN THE COASTAL ZONE M.S. Thesis
Ann H. Berger Oct. 1975 54 p
(PB-249799/8; NOAA-76011507) Avail: NTIS HC $4.50 CSCL 13B

The 'methods of control of land and water uses in the coastal zone' which were authorized by the Coastal Zone Management Act of 1972 (CZMA) are examined. These methods determine the manner in which the state's coastal zone management program will be implemented. The three methods are: (1) local regulation according to state guidelines; (2) direct state regulation; (3) state administrative review of plans for consistency with state management program. The potential advantages for each method are analyzed. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-24876# Rochester Univ., N.Y. Dept. of Microbiology.
THE PHYSIOLOGICAL BASES FOR MICROBIAL BAROTOLERANCE Annual Technical Report, 31 Dec. 1974 - 31 Dec. 1975
Robert E. Marquis 31 Dec. 1975 33 p
(Contract N00014-75-C-0634; NR Proj. 136-924)
(AD-A018892; TR-4) Avail: NTIS CSCL 06/19

The inhibition of streptococcal growth by hydrostatic pressure was found to be the result of an increased demand for adenosine triphosphate under pressure coupled with a somewhat diminished supply. The increased demand seemed to be due to pressure stimulation of membrane adenosine triphosphatase. it was found also that pressure markedly upsets electrolyte balances in organisms such as Streptococcus faecalis but not in organisms such as Escherichia coli or Bacillus licheniformis. Data is presented in this report to suggest that one atmosphere is not the optimal growth pressure for many bacteria, but that growth at 100 atmospheres and a temperature slightly above the optimum is faster and more extensive than is growth at any temperature at one atmosphere. Data is presented also to show that bacterial growth under nonoptimal conditions is highly sensitive to pressure, and that at the low temperatures in natural aquatic environments, pressures as low as 50 atmospheres can have major inhibitory effects on growth of mesophilic or psychrotrophic bacteria. Finally, it was found that high-pressure oxygen stimulates synthesis and excretion of materials that absorb light of 260 nm wavelength and that the toxicity of oxygen may be related to derangements in nucleic acid metabolism. Author (GRA)

N76-24877# Seton Hall Univ., South Orange, N.J. Dept. of Biology.
THE EFFECT OF HYPERBARIC OXYGEN AND HELIUM ON VIRUS REPLICATION AND HOST PATHOLOGY Final Report, 1 Apr. 1968 - 31 Jul. 1974
Ernest V. Orsi 31 Dec. 1975 8 p
(Contract N00014-68-A-0340-0001)
(AD-A018894; TR-2) Avail: NTIS CSCL 06/13

There is strong experimental evidence that virus infection after exposure to hyperbaric oxygen stress 'favors the virus over the host cell' Viral mRNA degredation is lessened by diminution of lysosomal RNA-ase leakage. In turn the interferon synthesizing capability of the host is markedly reduced by direct action of hyperbaric oxygen or compounds such as adrenochrome which mimic its action under normal pressure. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-24878*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MEDICAL MICROBIOLOGICAL ANALYSIS OF APOLLO-SOYUZ TEST PROJECT CREWMEMBERS
Gerald R. Taylor and S. N. Zaloguev Apr. 1976 26 p refs
(NASA-TM-X-58180; JSC-11021) Avail: NTIS HC $4.00 CSCL 06E

The procedures and results of the Microbial Exchange Experiment (AR-002) of the Apollo-Soyuz Test Project are described. Included in the discussion of procedural aspects are methods and materials, in-flight microbial specimen collection, and preliminary analysis of microbial specimens. Medically important microorganisms recovered from both Apollo and Soyuz crewmen are evaluated. Author

N76-24879*# Stanford Univ., Calif. Integrated Circuits Lab.
ULTRASONIC DOPPLER MEASUREMENT OF RENAL ARTERY BLOOD FLOW Progress Report, 1 Mar. 1974 - 31 Aug. 1975
William R. Freund and James D. Meindl Aug. 1975 91 p refs
(Grant NGR-05-020-615)
(NASA-CR-148131; SEL-76-004) Avail: NTIS HC $5.00 CSCL 06B

An extensive evaluation of the practical and theoretical limitations encountered in the use of totally implantable CW Doppler flowmeters is provided. Theoretical analyses, computer models, in-vitro and in-vivo calibration studies describe the sources and magnitudes of potential errors in the measurement of blood flow through the renal artery, as well as larger vessels in the circulatory system. The evaluation of new flowmeter/transducer systems and their use in physiological investigations is reported. Author

N76-24880*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECTS OF A 12-HOUR SHIFT IN THE WAKE-SLEEP CYCLE ON PSYSIOLOGICAL AND BIOCHEMICAL RESPONSES AND ON MULTIPLE TASK PERFORMANCE Final Report
E. A. Higgins (FAA, Oklahoma City, Oklahoma), W. D. Chiles (FAA, Oklahoma City, Oklahoma), J. M. Mckenzie (FAA, Oklahoma City, Oklahoma), P. F. Iampietro (AFOSR, Arlington, Va.), C. M. Winget, G. E. Funkhouser (FAA, Oklahoma City, Oklahoma), M. J. Burr (FAA, Oklahoma City, Oklahoma), J. A. Vaughan (FAA, Oklahoma City, Oklahoma), and A. E. Jennings (FAA, Oklahoma City, Oklahoma) Washington FAA Oct. 1975 27 p refs
(NASA-TM-X-74115; AD-A021518/6; FAA-AM-75-10) Avail: NTIS HC $4.00 CSCL 06/19

Fifteen male volunteers were studied in three groups of five each. The first 4 days of the experiment they slept nights and worked days. On the fifth night, they slept only 3 hours before starting a 10-day period in which the wake-sleep cycle was altered by 12 hours. According to a subjective sleep survey, the total quantity and quality of sleep did not change significantly when the cycle was altered. According to the subjective fatigue index, the total fatigue for the awake periods was not significantly changed. The times within days for greatest fatigue were altered and 9 days were required for a complete reversal of the daily pattern. Of the physiological parameters measured, those making the most rapid response to stress rephased in the shortest period of time after the shift. From the shortest to longest mean rephasal times, these were: heart rate norepinephrine, epinephrine, potassium, sodium, internal body temperature, and 17-ketogenic steroids. Author

N76-24881# Veterans Administration, Washington, D.C. Research Center for Prosthetics.
BULLETIN OF PROSTHETICS RESEARCH, SPRING 1975
1975 408 p refs
(AD-A018516; BPR-10-23; LC-66-60273) Avail: NTIS CSCL 06/12

Contents: Editoral-control concepts in prosthetics; Physical response of SACH feet under laboratory testing; Electrode implantation in the human body; New head Control for Quadriplegic patients; The Lift lock--a device to increase the lifting ability of dual-control prostheses; A voluntarily controlled electrohydraulic above-knee prosthesis; Computer optimization of polycentric prosthetic knee mechanisms; Transferring load to flesh-part VIII. Stasis and stress; A five-year review of clinical experience with Johns Hopkins University externally powered

upper-limb prostheses and orthoses; VA prosthetics center research report; Highlights of other VA research programs. GRA

N76-24882# Army Research Inst. of Environmental Medicine, Natick, Mass.
US ARMY MEDICAL RESEARCH AND DEVELOPMENT TECHNICAL REPORT Annual Progress Report, 1 Jul. 1974 - 30 Jun. 1975
1 Jul. 1975 182 p refs
(DA Proj. 3A7-62758-A-827; DA Proj. 3A1-61102-B-71R)
(AD-A018435) Avail: NTIS CSCL 06/5

Contents: Prevention of military environmental medical casualties by improved information transfer; Biomedical impact of military clothing and equipment design including the selection of crew compartment environments; Prevention and treatment of disabilities associated with military operations in the heat; The relationship between physical exercise and the health, efficiency and morale of the soldier; Development of performance measures for simulated and real military team tasks; Development and characterization of models of heat injuries and disabilities and other heat responses of the soldier; Preservation of myelinated peripheral nerve; and metabolic aspects of thermoregulation. GRA

N76-24883# School of Aerospace Medicine, Brooks AFB, Tex.
ANALYSIS OF HUMAN BODY COMPOSITION DATA AS RELATED TO HEIGHT AND AGE Final Report, Feb. 1964 - Aug. 1971
Clarence F. Theis Oct. 1975 43 p refs
(AF Proj. 7930)
(AD-A018350; SAM-TR-75-38) Avail: NTIS CSCL 06/16

In this study, human body composition was determined on 696 male volunteers. The study was a cross sectional study and covered a period of time from February 1964 to August 1971. Data including age, barefoot height, nude body weight, volume of displacement, fat, lean body mass, and residual lung volume were obtained on each subject. From these data, both simple and multiple linear regression equations based on height and age were computed for each of the following variables: Body weight, lean body mass, fat mass, fat/body weight ratio, fat/lean body mass ratio, density, and residual lung volume. Tolerance limits were also computed for the simple linear regression equations. Author (GRA)

N76-24884# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHAIR FOR STUDYING VESTIBULAR ANALYZER
V. Belkin 23 Apr. 1975 10 p Transl. into ENGLISH from Meditsinskaya Gazeta (USSR), no. 7, 22 Jan. 1975 p 3
(AD-A018251; FTD-ID(RS)I-1232-75) Avail: NTIS CSCL 05/10

The chair's operating principle is based on stimulating the vestibular analyzer of the individual being studied by creating different angular accelerations. Biopotentials are transmitted from the individual under observation to recording instruments by a collector installed on the chair's rotational axis. When necessary, the chair's back can be adjusted and fixed in any inclined position - from vertical to horizontal. A free-standing panel controls the chair's operation. The chair's functional possibilities are on a level with the best models in the world. The time of the action of acceleration is set automatically. GRA

N76-24885# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF BREATHING 100 PERCENT OXYGEN ON SHORT-TERM MEMORY OF MILITARY OFFICERS WHILE UNDER HEAT STRESS M.S. Thesis
Robert Louis Krubsack Sep. 1975 42 p refs
(AD-A018321) Avail: NTIS CSCL 06/19

Using a serial short term memory task, subjects were required to respond to symbols presented one-back, two-back, and three-back from a randomly presented list of four different symbols while breathing either 100 percent oxygen or atmospheric air with an oxygen mask in a heat stressful environment. The purpose of the experiment was to determine if breathing 100 percent oxygen had any effect on the short term memory of a subject under heat stress. Analysis of the data collected from 10 subjects under heat stress indicated breathing pure oxygen had no effect in the 15 minute period on short term memory. GRA

N76-24886# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF ALCOHOL INGESTION ON SHORT TERM MEMORY AND ATTENTION M.S. Thesis
Christopher Michael Grauert Sep. 1975 60 p refs
(AD-A018311) Avail: NTIS CSCL 06/15

Using a serial short term memory task, subjects were required to respond to stimuli presented one-back, two-back, and three-back from a random sequence of four different symbols before alcohol ingestion, after alcohol ingestion and again after alcohol with motivation. The purpose of the experiment was to determine whether alcohol had an adverse effect on Short Term Memory and, once intoxicated, whether the degradation of Short Term Memory could be overcome by attention. Analysis of the data collected from 10 subjects showed that alcohol adversely affected Short Term Memory in all three delay modes, while motivation had no effect in overcoming this Short Term Memory degradation due to alcohol ingestion. Author (GRA)

N76-24887# Army Research Inst. of Environmental Medicine, Natick, Mass.
A SQUIRREL MONKEY BEHAVIORAL MODEL FOR HUMAN ACUTE MOUNTAIN SICKNESS
L. E. Banderet Apr. 1975 23 p refs
(DA Proj. 3A1-61102-B-71R)
(AD-A019177; USARIEM-M-30-75) Avail: NTIS CSCL 06/19

The research determined if squirrel monkey (SM) behavioral changes at high altitude are a model for human acute mountain sickness (AMS). Two monkeys were studied at 0, 3,700, 4,000, and 4,300 m in chambers instrumented for continuous measurement of climbing and chamber location. Food and water consumption and body weight were measured daily. All measures were incrementally sensitive to altitude levels, and their time courses resembled that for human AMS. In another study, behavioral changes at high altitude were minimal when a treatment regime beneficial for man was investigated. Thus, SM behaviors at high altitude appear a promising model for the evaluation of prophylactic strategies and study of human AMS. GRA

N76-24888# Army Research Inst. of Environmental Medicine, Natick, Mass.
EFFECTS OF HYPOXIA ON PERIPHERAL VISUAL RESPONSE TO DIM STIMULI
John L. Kobrick Apr. 1975 28 p refs
(DA Proj. 3A7-62758-A-827)
(AD-A019106; USARIEM-M-31-75) Avail: NTIS CSCL 06/19

Response times (RT's) of 9 Ss were obtained for detection of 48 flash stimuli distributed throughout the visual field during 3 1/4 hour exposures to each of 4 hypoxia conditions (0, 13,000, 15,000, 17,000 feet equivalent elevation). The luminance of all stimuli were set in common at the detection threshold value for the visual periphery. RT's were impaired in direct relation to hypoxic exposure severity, the peak impairments occurring within 90 minutes followed by gradual recovery. Since the present results showed less impairment than previous data for brighter stimuli using the same task, it is concluded that stimulus contrast is more critical to peripheral signal detection than absolute stimulus luminance, particularly under hypoxia exposure. GRA

N76-24889# Army Research Inst. of Environmental Medicine, Natick, Mass.
RADIOGRAPHIC CHANGES IN CARDIAC DIMENSIONS DURING EXHAUSTIVE EXERCISE IN MAN
John T. Maher, George A. Beller, John M. Foster, and L. Howard Hartley Sep. 1975 20 p refs
(DA Proj. 3A1-61102-B-71R)
(AD-A019100; USARIEM-M-8-76) Avail: NTIS CSCL 06/16

To further characterize the cardiocirculatory response to endurance exercise, serial changes in transverse cardiac diameter (TCD) were evaluated noninvasively using a roentgenographic technique. Forty-inch ECG-synchronized anteroposterior X-rays of the chest were taken of 9 healthy young men at rest, during the course of supine bicycle exercise, and at exhaustion. Exposures were triggered in end-diastole during end-expiration. Under the conditions of this study, the normal physiologic response of decrease in heart size with increase in heart rate was observed. GRA

N76-24890# Undersea Medical Society, Bethesda, Md.
PROCEEDINGS OF THE UNDERSEA MEDICAL SOCIETY WORKSHOP (7TH) ON MEDICAL ASPECTS OF SMALL SUBMERSIBLE OPERATIONS
D. A. Hall and P. G. Linaweaver 1975 204 p refs Workshop held at Submarine Devel. Group 1, San Diego, Calif., 19-20 Nov. 1974
(Contract N00014-74-C-0319)
(AD-A018474; WS-7-1-75) Avail: NTIS CSCL 06/19

Contents: Background information; Submersible incidents; Behavioral considerations; Unique vehicles; and Non-U.S. submersible program summaries. GRA

N76-24891# Logical Technical Services Corp., New York.
INVESTIGATIONS INTO THE RELIABILITY OF ELECTRO-PHOTOGRAPHY Final Report
David Faust, Graham L. Gross, Harry J. Kyler, and John O. Pehek 30 Sep. 1975 85 p refs
(Contract MDA903-75-C-0208; ARPA Order 2812)
(AD-A018806; FR-1) Avail: NTIS CSCL 06/16

Investigations into corona-discharge photography show that subjects placed in a high-voltage field exhibit corona that may be recorded photographically. The corona formation and structure depend on the applied field strength and gradient, the type of film used, and the waveform and the pulse repetition rate of the applied voltage. Specimen properties affecting corona formation include resistivity, geometry, and moisture content; other factors may also be important. The discharge mechanism is similar to that of classical point to plane studies. CD photography is successfully used to study temperature dependence of skin hydration in distilled water and saline solutions. Evidence indicates that variations in certain physiological parameters may be used to determine response to psychological stimuli via corona discharge photography. GRA

N76-24892# Armed Forces Radiobiology Research Inst., Bethesda, Md.
POLAROGRAPHIC MEASUREMENT OF LOCAL CEREBRAL BLOOD FLOW IN THE CONSCIOUS AND ANESTHETIZED PRIMATE
J. M. Fein, J. A. Willis, J. R. Hamilton, and L. J. Parkhurst Aug. 1975 33 p refs
(DNA Proj. NWED-QAXMC912)
(AD-A018665; AFRRI-SR-75-24) Avail: NTIS CSCL 06/16

This study was undertaken to evaluate the brain hemodynamics of the primate Macaca mulatta in the conscious and anesthetized state. A polarographic circuit was utilized for repetitive measurements of local and average total cerebral blood flow in the conscious state, during analgesia-paralysis and in the anesthetized state. The electrochemical considerations and in vitro testing are described. Blood flow values were highest in sensory and motor cortex (92.5 + or 3.5 and 86.2 + or - 2.6 ml/100 g per min), while there were no significant differences found between other regions of association cortex. Mean deep grey matter blood flow values ranged between 57.6 + or - 3.8 and 69.2 + or - 3.4 ml/100 g per min. The mean local blood flow for the centrum semiovale was found to be 19.5 + or - 1.2 ml/100 g per min, and that for pontine tegmentum was 58.1 + or - 3.5 ml/100 g per min. At any one electrode locus, at steady-state levels of arterial blood gases, the reproducibility of blood flow ranged between 11-18 percent. Seventy-five percent nitrous oxide-25 percent oxygen in combination with a paralytic agent produced a questionably significant drop in caudate nucleus blood flow. The depressant effects of anesthetic doses of sodium pentobarbital on cerebral blood flow, however, were significant at most electrode sites. These data indicate that the measured blood flow rates within small brain volumes are critically affected by barbiturate anesthesia and seriously question the value of published reports in which these agents were utilized. Author (GRA)

N76-24893# School of Aerospace Medicine, Brooks AFB, Tex.
AN AUTOMATED DMFB METHOD FOR THE DETERMINATION OF URINARY AMINO NITROGEN Final Report, Jun. 1974 - Jul. 1975
Jesus B. Garcia, Jr. and Frank Bernal Dec. 1975 10 p refs (AF Proj. 7930)
(AD-A018720; SAM-TR-75-43) Avail: NTIS CSCL 06/1

A method using 2,4-dinitrofluorobenzene (DNFB) is described for the automatic determination of urinary amino nitrogen. Based on existing manual methods, it introduces reagents that are easily adaptable to automated techniques. A mean urinary amino nitrogen value of 77.1 mg amino N/gm creatinine was obtained for a group of healthy male subjects, compared to a range of 52 to 80 mg reported by other investigators. Direct comparison of analytical results obtained by the automated method and a manual DNFB method on several urine samples yielded a mean difference of 1.34% between the methods. Author (GRA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-24894*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PSYCHOPHYSICAL RELATIONSHIPS CHARACTERIZING HUMAN RESPONSE TO WHOLE-BODY SINUSOIDAL VERTICAL VIBRATION
Jack D. Leatherwood and Thomas K. Dempsey Washington Jun. 1976 35 p refs
(NASA-TN-D-8188; L-10496) Avail: NTIS HC $4.00 CSCL 05E

An experimental investigation determined that the psychophysical relationships between subjective discomfort evaluations to vibratory stimuli and subjective evaluations of the intensity of vibratory stimuli can be expressed in a linear fashion. Furthermore, significant differences were found to exist between discomfort and intensity subjective response for serveal but not all discrete frequencies investigated. The implication of these results is that ride quality criteria based upon subjective evaluation of vibration intensity should be applied cautiously in the development of criteria for human comfort. Author

N76-24895# Naval Training Equipment Center, Orlando, Fla.
ADAPTIVE TRAINING OF MANUAL CONTROL: PERFORMANCE MEASUREMENT INTERVALS AND TASK CHARACTERISTICS In-house Report, Sep. 1974 - Sep. 1975
G. L. Richard and D. A. Norman Nov. 1975 21 p refs
(AD-A019233; NAVTRAEQUIPC-IH-252) Avail: NTIS CSCL 05/9

An experiment is reported concerning relations between the measurement of trainee performance and parameters of the simulated airframe of an adaptive, aircraft roll-control, training task. Five values for the performance measurement interval (PMI) were chosen so as to bracket the roll rate time constant of the simulator's lateral transfer function, and an acquisition-then-transfer experimental design was used to assess trainee skill development. When the PMI was shorter than the break frequency of the lateral transfer function, subjects experienced greater difficulty in developing criterion-level control than when longer PMI's were used. GRA

N76-24896# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CREW AND NEW SYSTEMS
N. Rudnyi and V. Ponomarenko 12 May 1975 20 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (USSR), no. 9, 1974 p 34-36
(AD-A018253; FTD-ID(RS)I-1256-75) Avail: NTIS CSCL 05/5

The report discusses aviation accidents as related to the psychological and mental characteristics of man in a performance environment, and stresses taking these factors into account when planning and designing new aviation technology. GRA

N76-24897# Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN EXPERIMENTAL EVALUATION OF THE SPOT WOBBLE METHOD OF SUPPRESSING RASTER STRUCTURE VISIBILITY Technical Report, 1 Mar. 1973 - 1 Mar. 1974
William S. Beamon and Harry L. Snyder Nov. 1975 47 p refs

(Contract F33615-71-C-1739)
(AD-A018566; AMRL-TR-75-63) Avail: NTIS CSCL 05/5

Television displays generate an image composed of a number of parallel raster lines. These lines, when visible, act as an interfering pattern and detract from operator performance in obtaining information from the video system. One way to reduce line visibility is to deflect the scanning spot vertically as it scans; this technique is commonly termed spot wobble. An experiment was conducted which evaluated changes in operator performance as indicated by the ranges at which targets were acquired and the number of correct responses to target presentation in a simulated air-to-ground search task. These performance parameters were evaluated at four spot wobble amplitudes and three viewing distances. The main findings were that spot wobble had no significant effect on the number of correct responses, but that large-amplitude spot wobble significantly increased the ranges at which targets were acquired. Additionally, several subjective indicators of preferred image quality were evaluated, and show that there is wide variance among subjects as to what image characteristics they prefer. GRA

N76-24898# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
EVALUATION OF THE EC II PROGRAMMABLE MAINTENANCE SIMULATOR IN T-2C ORGANIZATIONAL MAINTENANCE TRAINING Final Report
Joann Wright and Jane Campbell 15 May 1975 41 p refs
(AD-A012336; NADC-75083-40) Avail: NTIS CSCL 05/9

An evaluation was conducted of the EC 2 training device, a computerized programmable simulator, used in three system courses of the T-2C Organizational Maintenance Training Program: the hydraulics and flight controls course, the environmental (utility) system course and the power plants and related systems course. The findings indicate that the simulator proved at least as equally effective as the conventional hardware units when used to teach general maintenance procedures. Author

N76-24899# Air Force Human Resources Lab., Brooks AFB, Tex.
USAF EVALUATION OF AN AUTOMATED ADAPTIVE FLIGHT TRAINING SYSTEM Interim Report, Jan. - Dec. 1974
James E. Brown, Wayne L. Waag, and Edward E. Eddowes Oct. 1975 62 p refs
(AF Proj. 1123)
(AD-A018612; AFHRL-TR-75-55) Avail: NTIS CSCL 05/9

The objectives of the study were: (1) to evaluate the training effectiveness of the Automated Flight Training (AFTS) in the F-4 training program; (2) to identify desired hardware and software modifications for operational AFTS devices; and (3) to identify effective methods of operational training use. The study was performed at Luke AFB, Arizona at the request of the Tactical Air Command (TAC). A class of 24 students assigned to F-4 combat crew training was randomly divided in two equal sized groups. One group received GCA training using the AFTS. The other group received normal GCA training from F-4 instructors. Performance data, questionnaire data, and maintenance data were collected and analyzed. Implications of the data for future use and procurement of additional systems are discussed. GRA

N76-24245 European Space Agency, Paris (France).
AIRCRAFT NOISE IN RESIDENTIAL AREAS: MEASUREMENT AND ANALYSIS
Hans Otto Finke, R. Martin et al *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 35-47 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 35-42 (For availability see N76-24243 15-07)

N76-24246 European Space Agency, Paris (France).
NOTES ON NOISE INDEX NUMBERS (TAKING INTO ACCOUNT THE RESULTS OF THE MUNICH AIRCRAFT NOISE INVESTIGATION CARRIED OUT BY THE GERMAN RESEARCH ASSOCIATION)
Klaus Matschat, E. A. Mueller, G. Zimmermann et al *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 48-52 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 43-47 (For availability see N76-24243 15-07)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-24900* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SELF-CONTAINED BREATHING APPARATUS Patent
John L. Sullivan (Scott Aviation Corp.), Eugene A. Giorgini (Scott Aviation Corp.), and Milo R. Simmonds, inventors (to NASA) (Scott Aviation Corp.) Issued 18 May 1976 17 p Filed 11 Nov. 1974 Supersedes N75-13534 (13 - 04, p 0457) Sponsored by NASA
(NASA-Case-MSC-14733-1; NASA-Case-MSC-14735-1; US-Patent-3,957,044; US-Patent-Appl-SN-522971; US-Patent-Class-128-142.2; US-Patent-Class-128-203; US-Patent-Class-137-DIG.9; US-Patent-Class-137-110) Avail: US Patent Office CSCL 06K

A self-contained breathing apparatus with automatic redundant fluid pressure controls and a facemask mounted low pressure whistle alarm is described. The first stage of the system includes pair of pressure regulators connected in parallel with different outlet pressures, both of which reduce the pressure of the stored supply gas to pressures compatible with the second stage breathing demand regulator. A primary regulator in the first stage delivers a low output pressure to the demand regulator. In the event of a failure closed condition of the primary regulator an automatic transfer valve switches on the backup regulator. A warning that the supply pressure has been depleted is also provided by a supply pressure actuated transfer valve which transfers the output of the first stage pressure regulators from the primary to the backup regulator. The alarm is activated in either the failure closed condition or if the supply pressure is reduced to a dangerously low level.
Official Gazette of the U.S. Patent Office

N76-24901*# Rockwell International Corp., Downey, Calif. Space Div.
STUDY TO DETERMINE EXTRAVEHICULAR MOBILITY UNIT (EMU) ADVANCED TECHNOLOGY REQUIREMENTS. VOLUME 1: EXECUTIVE SUMMARY Final Report
7 May 1976 20 p refs 2 Vol.
(Contract NAS2-8957)
(NASA-CR-137840; SD-76-SA-0026-Vol-1) Avail: NTIS HC $3.50 CSCL 06K

Requirements are derived for extravehicular mobility units that are responsive to the needs of typical shuttle payloads. Requirements which might require technology advances are stressed. Author

N76-24902*# Rockwell International Corp., Downey, Calif. Space Div.
STUDY TO DETERMINE EXTRAVEHICULAR MOBILITY UNIT (EMU) ADVANCED TECHNOLOGY REQUIREMENTS. VOLUME 2: TECHNICAL ANALYSIS Final Report
7 May 1976 114 p refs 2 Vol.
(Contract NAS2-8957)
(NASA-CR-137841; SD-76-SA-0026-Vol-2) Avail: NTIS HC $5.50 CSCL 06K

For abst act, see N76-24901.

N76-24903*# Old Dominion Univ. Research Foundation, Norfolk, Va.
DEVELOPMENT OF RIDE COMFORT CRITERIA FOR MASS TRANSIT SYSTEMS Final Report
Raymond H. Kirby, Peter J. Mikulka, and Glynn D. Coates May 1976 32 p refs
(Grant NsG-1042)
(NASA-CR-147962; PR-76-7) Avail: NTIS HC $4.00 CSCL 05H

Two studies were conducted on the effects of simultaneous sinusoidal vibration in the vertical and lateral axes on ratings of discomfort in human subjects in a simulated passenger aircraft. In the first experiment each of 24 subjects experienced each of ten levels of vertical frequency in combination with each of ten levels of lateral frequency vibration and rated the discomfort

produced on a nine-point, unipolar scale. In the second experiment 72 subjects experienced one of four levels of vertical frequency at each of four levels of vertical amplitude combined with 16 (or 4 x 4) lateral frequency and amplitude conditions. The results of these two studies strongly suggest that there are effects on discomfort that occur when subjects are vibrated in several axes at once that cannot be assessed with research using vibration in only one axis. Author

N76-24904*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
PPP EFFECTIVENESS STUDY
James D. Arbet and R. L. Benbow 7 May 1976 42 p refs (Contract NAS9-14780)
(NASA-CR-147720; Design-Note-17) Avail: NTIS HC $4.00 CSCL 05H

This design note presents a study of the Procedures and Performance Program (PPP) effectiveness. The intent of the study is to determine manpower time savings and the improvements in job performance gained through PPP automated techniques. The discussion presents a synopsis of PPP capabilities and identifies potential users and associated applications, PPP effectiveness, and PPP applications to other simulation/training facilities. Appendix A provides a detailed description of each PPP capability. Author

N76-24905# Army Aeromedical Research Lab., Fort Rucker, Ala.
THE USE OF OPAQUE LOUVRES AND SHIELDS TO REDUCE REFLECTIONS WITHIN THE COCKPIT, COMPUTER PROGRAMS FOR TWO APPROACHES TO THE PROBLEM Final Report
Wun C. Chiou, Frank F. Holly, Chun K. Park, and Alford A. Higdon, Jr. Nov. 1975 22 p refs
(AD-A018468; USAARL-76-6) Avail: NTIS CSCL 05/5

Opaque shields can be used to channel light and thereby reduce reflections within the cockpit. These shielding devices range from the standard glare shield on top of the instrument panel to the more experimental use of Light Control Film and Micromesh for this purpose. Previous work in this series has demonstrated two mathematical approaches to a specific reflection problem in the AH-1 aircraft, namely, the reflections coming from the portion of canopy directly above the gunner's head. It was felt that it would be useful to demonstrate the compatibility of these two approaches and to publish the computer programs (FORTRAN) for each approach for possible use by others. GRA

N76-24906# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN OF AN OPTICAL LINK FOR A SIDE-MOUNTED HELMET DISPLAY USING OFF-THE-SHELF LENSES M.S. Thesis
James T. Larkins Mar. 1975 111 p
(AD-A018332; GEO/PH/75-6) Avail: NTIS CSCL 05/8

The Helmet-Mounted Display (HMD) is a primary component of a Visually-Coupled System (VCS). Commercially available optical links for the HMDs are available but expensive. Ray-tracing techniques were employed to investigate the possibility of using 'off-the-shelf' lenses in an optical link. Four inexpensive, simple-magnifier systems were designed and evaluated with a new device, the HMD optical test instrument. The theory of geometric optics limits such an optical to the simple-magnifier systems. GRA

N76-24907# Systems Technology, Inc., Hawthorne, Calif.
EFFECTS OF WIDEBAND AUDITORY NOISE ON MANUAL CONTROL PERFORMANCE AND DYNAMIC RESPONSE Final Report, Jul. 1971 - Mar. 1975
R. Wade Allen and Henry R. Jex Oct. 1975 31 p refs
(Contract F33615-73-C-4003; AF Proj. 7231)
(AD-A018667; STI-TR-1027-2; AMRL-TR-75-65) Avail: NTIS CSCL 05/8

Noise is a common stress in the aerospace environment, and the purpose of this study was to investigate its effect on manual control performance and associated behavior. Nine subjects were subjected to white noise at four intensity levels of 55 db, 75 db, 95 db, and 115 db while performing a simulated pitch/roll tracking task with a high attentional demand. Performance actually improved under noise, presumably due to an arousal effect. The human operator's dynamic response properties were not affected by noise, however, and the performance effects arose from a reduction in remnant (subject tracking noise) and possibly cross coupling internal to the operator. A measure of subjective reaction to the noise environment showed high sensitivity to the various noise levels and some habituation over three experimental sessions. Also, tracking performance showed steady improvement over the three sessions, probably due to learning. Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N76-24908# Sandia Labs., Albuquerque, N.Mex.
INSTRUCTION MANUAL FOR THE MINICOMPUTER SYSTEM OF DIVISION 2151
E. D. Machin Nov. 1975 28 p refs
(Contract AT(29-1)-789)
(SAND-75-0428) Avail: NTIS HC $4.00

Basic step-by-step instructions are provided for use of the HP 2114A minicomputer system in Division 2151. These instructions cover the range from loading magnetic tapes on the magnetic tape unit to putting the computer into a usable condition to control the peripheral equipment. Description and use of some of the available subroutines are provided, as well as the procedure for processing HP FORTRAN programs to obtain usable binary object tapes. Instructions to the HP 2114A computer through the computer switch register are always by the base-8 numerical number system. A brief description of the base-8 number system and the computer switch register is also included. Author (ERA)

N76-24909# Florence Univ. (Italy). Ist. di Elettronica.
USE OF A/D/A UNIT TO PROCESS ANALOG SIGNALS BY DIGITAL COMPUTER [USO DI UNA UNITA A/D/A/ PER IL TRATTAMENTO DI SEGNALI ANALOGICI MEDIANTE ELABORATORE DIGITALE]
Franco Pirri 1974 33 p refs In ITALIAN
(R-2-74) Avail: NTIS HC $4.00

An analog-digital-analog converter for sound generation via digital computer is presented. The I/O devices of the HP2100A computer are described with regard to data transfer, interrupts, and priorities. The various modes of the A/D/A converter are detailed with regard to the INPUT, OUTPUT, I/O SYNC, and AUTO modes. The programs required to subdivide computer words, are discussed. ESA

N76-24910# RCA Government and Commercial Systems, Moorestown, N.J. Missile and Surface Radar Div.
REAL-TIME TACTICAL OPERATING SYSTEM STUDY, VOLUME 1 Final Report, Jul. 1974 - Sep. 1975
S. Steele, J. Kulp, A. Decegama, C. Yeisley, and T. Hoke Oct. 1975 315 p
(Contract DAAB07-74-C-0597; DA Proj. 1S7-62701-AH-92-B-1)
(AD-A016938; ECOM-74-0597-F-Vol-1) Avail: NTIS CSCL 09/2

A detailed analysis and characterization of tactical real-time operating systems (RTOS) that can be used to develop: (1) a guideline for specifying and designing tactical RTOS and (2) a generalized, parameterized RTOS module for a broad class of tactical systems is presented. The approach taken in this study was to integrate existing technology and past design experiences into a framework for RTOS design and performance evaluation. The final report presents: (a) An RTOS Canonical Form - this is a complete description of a set of real-time operating systems in terms of tactical environments, OS architecture, functional components, OS interfaces, data structures, and critical design parameters. (b) Methodology for RTOS Specification and Design - a logical step by step sequence that would allow for efficient specification and/or design of a tactical RTOS. (c) Recommendations for a Performance Evaluation Tool - a tool that would enable the evaluation of a unique RTOS design given a particular set of environmental parameters. GRA

N76-24911# RCA Government and Commercial Systems, Moorestown, N.J. Missile and Surface Radar Div.
REAL-TIME-TACTICAL OPERATING SYSTEM STUDY, VOLUME 2 Final Report, Jul. 1974 - Sep. 1975
S. Steele, J. Kulp, A. Decegama, C. Yeisley, and T. Hoke Oct. 1975 288 p refs
(Contract DAAB07-74-C-0597; DA Proj. 1S7-62701-AH-92-B-1)
(AD-A016941; ECOM-74-0597-F-Vol-2) Avail: NTIS CSCL 09/2

For abstract, see N76-24910.

N76-24912# RAND Corp., Santa Monica, Calif.
THE RAND MONITOR/STIMULUS-GENERATOR: HARDWARE IMPLEMENTATION Interim Report
Roy I. Yoshimura Nov. 1975 35 p
(Contract F44620-73-C-0011)
(AD-A018769; R-1716-PR) Avail: NTIS CSCL 09/2

An experimental technique for on-line systems analysis was developed at Rand which required an inexpensive device to input simulated loads into a system and to measure, in real time, the resulting response times. The Rand Monitor/Stimulus-Generator (RMS) was developed to support this technique. This report discusses the operational characteristics and overall logic design of the RMS. GRA

N76-24913# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
MICROPROCESSOR REALIZATION OF A DIGITAL FILTER M.S. Thesis
Michael J. Parkinson 1975 93 p
(AD-A018910; AFIT-CI-76-1) Avail: NTIS CSCL 09/4

A study is made concerning the theoretical aspects of digital filtering techniques and the realization of digital filters using a microprocessor to realize the digital transfer functions. Emphasis is on recursive digital filtering using the bilinear z-transformation. Background information is provided on data conversion and processing preceding the development of the z-transform and digital filter design by frequency domain techniques. Examples of second order digital filter realizations and block diagrams are presented. Included is a discussion of the sources of errors unique to digital techniques. An analog-to-digital and digital-to-analog converter was constructed to interface with the microprocessor. The microprocessor performed the necessary computations of the digital filter algorithm, thereby providing experimental verification of the theory. The results of this confirmation are illustrated. GRA

N76-24914# Stanford Research Inst., Menlo Park, Calif.
AN INTERLISP RELATIONAL DATA BASE SYSTEM
Stephen Weyl Nov. 1975 40 p
(Contract N00014-71-C-0210)
(AD-A018962; SRI-TN-11) Avail: NTIS CSCL 09/2

This report describes the file system for the experimental large file management support system currently being implemented at SRI. INTERLISP, an interactive, development-oriented computer programming system, has been augmented to support applications requiring large data bases maintained on secondary store. The data base support programs are separated into two levels: an advanced file system and relational data base management procedures. The file system allows programmers to make full use of the capabilities of on-line random access devices using problem related symbolic primitives rather than page and word numbers. It also performs several useful data storage functions such as data compression, sequencing, and generation of symbols which are unique for a file. GRA

N76-24915# Stanford Univ., Calif. Electronics Labs.
THE MINERVA MULTI-MICROPROCESSOR
Lawrence C. Widdoes, Jr. Jul. 1975 28 p
(Contract N00014-75-C-0601)
(AD-A018960; SU-TR-62) Avail: NTIS CSCL 09/2

A multiprocessor system is described which is an experiment in low cost, extensible, multiprocessor architectures. Global issues such as inclusion of a central bus, design of the bus arbiter, and methods of interrupt handling are considered. The system initially includes two processor types, based on microprocessors, and these are discussed. Methods for reducing processor demand for the central bus are described. GRA

N76-24916# Hughes Aircraft Co., Culver City, Calif. Data Systems Div.
HIGH SPEED MICROPROCESSOR STUDY
Ronald C. Barrett, Robert H. Bork, Gregory Fox, Donald W. Hattendorf, and Michael D. Vahey Mar. 1975 74 p
(Contract F33615-74-C-1217)
(AD-A018702; HAC-P74-461; AFAL-TR-75-44) Avail: NTIS CSCL 09/2

The architectural features, instruction set and device technology of a microprocessor which can meet the requirements of higher speed avionics applications are defined in this report. The results of processing requirements studies for a modular digital scan converter and a synthetic aperture ground map radar are reported. Microprocessor design tradeoffs for high speed operation are presented and a design is chosen. The results of partitioning this design onto custom CMOS/SOS and low power Schottky TTL chips are presented. GRA

N76-24917# TRW Systems Group, Redondo Beach, Calif.
COMPUTER SECURITY TECHNOLOGY REFERENCE MANUAL Reference Manual, Aug. 1973 - Mar. 1975
Richard White Nov. 1975 341 p refs
(Contract F30602-74-C-0008; AF Proj. 5581)
(AD-A019439; RADC-TR-75-283) Avail: NTIS CSCL 09/2

The purpose of this reference manual is to make available to the USAF an unclassified, continuously maintainable handbook of the most current technology which can be employed in the design and acquisition of secure computer systems. This handbook is referred to as the Computer Security Technology Reference Manual (CSTRM) and is intended to provide a basis for evaluating and improving the security of existing USAF computer systems with emphasis on the hardware and software components of these systems. Although it may also serve as a source of computer security technology for the designers of future USAF computer systems, the manual is intended primarily for those USAF personnel currently charged with the responsibility of establishing, maintaining and improving the security of existing computer systems. GRA

N76-24918# University of Southern Calif., Marina del Rey. Information Sciences Inst.
AN APPROACH TO PROVIDING A USER INTERFACE FOR MILITARY COMPUTER-AIDED INSTRUCTION IN 1980
Louis Gallenson Nov. 1975 27 p refs
(Contract N00014-75-C-0710; ARPA Order 2930; NR Proj. 154-374; RR0420601)
(AD-A019485; ISI/RR-75-43) Avail: NTIS CSCL 09/2

A recent needs study determined that most of the terminal

requirements for military CAI applications can be satisfied with mainstream commercial terminals. Additional development, however, is likely to be required to satisfy two of the capabilities (limited graphics and prerecorded visuals). The expected architecture of commercial terminals will make it easy to modify and customize them to meet all the identified CAI needs. The military community is also expected to use computer networks to satisfy an appreciable portion of its requirements. Commercial terminals and available computer networks provide the basis for an effective and economical user interface to military CAI systems. GRA

N76-24919# North Carolina Univ., Chapel Hill.
SAMPLING FROM THE POISSON DISTRIBUTION ON A COMPUTER
George S. Fishman Dec. 1975 22 p refs
(Contract N00014-67-A-0321-0008)
(AD-A018669; TR-75-11) Avail: NTIS CSCL 09/2

The purpose of this paper is to review five alternative methods of generating a Poisson distributed random variable on a digital computer. GRA

N76-24920# Office of Naval Research, London (England).
COMPUTER AIDED DESIGN AND DESIGN AUTOMATION IN EUROPE
Waldo G. Magnuson, Jr. 20 Oct. 1975 58 p refs
(AD-A018996; ONRL-R-13-75) Avail: NTIS CSCL 09/5

A summation of the state of computer aided electronic circuit design and digital circuit design automation is presented. The conclusions are based on visits made to universities, research laboratories, industrial companies and attendance at conferences during the period 1 July 1974 to 1 July 1975. An attempt is made to make a comparison of CAD and DA in the United States with the activity in Europe. Similarly the trends and future emphasis in these fields in Europe are commented upon. GRA

N76-24921# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
DESIGN OF DIGITAL FILTERS AND ARRAYS OF SENSORS Final Report, 1 Sep. 1971 - 31 Aug. 1975
James T. Lewis, Richard Murphy, William Cooper, and D. W. Tufts 15 Nov. 1975 39 p refs
(Contract N00014-68-A-0215-0006)
(AD-A019462; URI-EE-4044/6) Avail: NTIS CSCL 09/2

A numerical method is presented for designing digital filters. The method allows one to minimize the mean-square error or noise power over some intervals of frequency, while simultaneously constraining the maximum error in other intervals of frequency. Thus, for example, one can minimize noise power from a stop band of frequencies while constraining signal fidelity in a passband of frequencies, by limiting the maximum pass-band deviation. Examples are presented of the results of an algorithm, based on linear programming, for improving beam patterns of an array of sensors. Both weighting coefficients and element locations are changed, and the objective is to minimize the maximum sidelobe, subject to a constraint in the look direction.
Author (GRA)

N76-24922# Naval Ship Research and Development Center, Bethesda, Md.
USER INTERFACES TO DATABASE MANAGEMENT SYSTEMS
David K. Jefferson Sep. 1975 14 p refs Presented at the 14th Ann. Tech. Symp., Washington, D. C., Ch. of the ACM, Gaithersburg, Md., 19 Jun. 1975 Revised
(TF53531009)
(AD-A019654; DTNSRDC-4751-Rev) Avail: NTIS CSCL 09/2

Users of database management systems are divided into four groups: databases administrators, programmers, parametric users, and casual users. The interfaces between user and system are divided into three groups: data-oriented, procedure-oriented, and problem-oriented. Two logical models of interfaces are described and evaluated: the network model and the relational model. An extended example is used to demonstrate advantages of each model. Efficiency of implementation is considered, particularly in regard to future hardware developments.
Author (GRA)

N76-24923# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.
DATA REDUCTION AND ANALYSIS PROGRAMS FOR THE HONEYWELL 635 TSS RELEASE 8.1 Interim Report, 1 Jul. 1972 - 30 Sep. 1975
Jamshed D. Mulla Dec. 1975 134 p refs
(Contract F30602-73-C-0001; AF Proj. 5581)
(AD-A019300; RADC-TR-75-293) Avail: NTIS CSCL 09/2

Four computer programs used to reduce and analyze data collected on the Honeywell 635 Time Sharing System are described. The purpose of the work was to obtain statistical data on the various Time Sharing System processes. Data items are classified into four major groups: Basic TSS Information, Individual Subsystem Data, Data from User Status Tables, TSS Memory Map. Author (GRA)

N76-24924# Michigan Univ., Ann Arbor. Systems Engineering Lab.
A STUDY OF INFORMATION IN MULTIPLE-COMPUTER AND MULTIPLE-CONSOLE DATA PROCESSING Final Technical Report, 1 Jul. 1972 - 30 Sep. 1975
K. B. Irani, M. F. Bauer, J. D. Mulla, M. F. Mitoma, and C. R. Sonnenburg Griffiss AFB, N. Y. RADC Nov. 1975 45 p refs
(Contract F30602-73-C-0001; AF Proj. 5581)
(AD-A019202; RADC-TR-75-276) Avail: NTIS CSCL 09/2

This final report summarizes the achievements from 1 Jul. 72 to 30 Sep. 75 of continuing research for the development and application of mathematical techniques for the analysis and optimization of computer systems. Author (GRA)

N76-24925# Illinois Univ., Urbana. Computer-Based Education Research Lab.
PLASMA DISPLAY, INTERACTIVE TECHNIQUES Final Report, 27 Jun. 1973 - 31 Dec. 1974
Roger L. Johnson Griffiss AFB, N. Y. RADC Dec. 1975 113 p refs
(Contract F30602-73-C-0370)
(AD-A019639; RADC-TR-75-157) Avail: NTIS CSCL 09/2

A research program to study and develop techniques for providing extended graphic display capabilities and efficient system design approaches based upon the use of advanced plasma display technology has been completed. The program included work on three major tasks. The first task was a study of new display terminal architecture features for use with plasma display/memory units which was undertaken to find ways of obtaining higher data handling efficiency, increasing diversity and flexibility of graphic performance, and developing more cost effective terminals and systems. The second task involved the design, implementation, and demonstration of a full scale electrical readout system for 512 x 512 Digivue 512-60 panels. The third task was a study to determine the feasibility of integrating parallel self-shift techniques with commercially available plasma display panels. GRA

N76-24926# Stanford Univ., Calif. Dept. of Computer Science.
EXPLORATORY STUDY OF COMPUTER INTEGRATED ASSEMBLY SYSTEMS Progress Report, 15 Sep. 1974 - 30 Nov. 1975
J. O. Binford, D. D. Grossman, E. Miyamoto, R. Finkel, and B. E. Shimano 30 Nov. 1975 300 p refs
(Grant NSF APR-74-01390-A02)
(PB-249022/5; NSF/RA/T-75-058) Avail: NTIS HC $9.25 CSCL 13H

The development of programmable assembly devices is discussed. The approach taken is to design and implement a complete computer integrated assembly system which can then be used as a research tool for studying problems in industrial automation. The complete system includes manipulators with tactile sensors and TV cameras, tools, fixtures, and auxiliary devices, a dedicated minicomputer, and a time-shared large computer equipped with graphic display terminals. The types of research activity underway include development of high level languages for assembly and for vision, libraries of generic assembly routines, geometric modeling of objects and constraints, assembly simulation, control algorithms, and adaptive methods of calibration. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-24927*# Houston Univ., Tex. Dept. of Mathematics.
USERS GUIDE UHMLE/RTCC VERSION; PROGRAM DOCUMENTATION SIGEXT EOD-LARSYS VERSION OF UHMLE
William A. Coberly (Tulsa Univ.) Mar. 1976 19 p refs
(Contract NAS9-12777)
(NASA-CR-147740; Rept-52; Rept-53) Avail: NTIS HC $3.50 CSCL 09B

A programmer guide for computing maximum likelihood estimates of mixture distributions from an unlabeled sample is presented. A subroutine provides graphic representation of mixture distributions. A.S.K.

N76-24928# Geselischaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
TESTING OF REAL-TIME SOFTWARE: ANALYSIS OF USER INTERVIEWS AND RELEVANT LITERATURE
G. Friesland and H. Ovenhausen May 1975 95 p refs In GERMAN
(KFK-PDV-39) Avail: ERDA Depository Libraries HC $7.75

The situation in the area of testing real-time software is unsatisfactory. During the first phase of the project PROMOTE (prozess orientiertes Modul- und Gesamttestsystem), an analysis of the present situation took place, results of which are summarized. Twenty-two users (industry, software houses, hardware manufacturers, and institutes) were interviewed. Discussions were held about the reliability of real-time software with special interest in error avoidance, testing, and debugging. The main aims of the literature analysis were elaboration of standard terms, comparison of existing test methods and systems, and definition of boundaries of related areas. During the further steps of this project some means and techniques will be worked out to test real-time software systematically. Author (ERA)

N76-24929# Sandia Corp., Albuquerque, N.Mex.
CDC 6600 SUBROUTINES FOR BESSEL FUNCTIONS AND AIRY FUNCTIONS
Donald E. Amos, Sharon L. Daniel, and M. Katherine Weston Sep. 1975 38 p refs
(Contract AT(29-1)-789)
(SAND-75-0147) Avail: NTIS HC $5.00

Subroutine BESJ implements the power series, the asymptotic expansion for x yields infinity, and the uniform asymptotic expansion for v yields infinity for J/sub v/(x). In the region x>v forward recursion is stable, and values from the asymptotic expansion for x yields infinity with small v are used to start the recursion for x>20. Except for x<1/2, where the series is used, the Miller backward recursive algorithm, normalized by the power series or the expansion of v yields infinity, is utilized to compute sequences of Bessel functions and cover other parts of the (v,x) plane where no normalization expression is available. The normalization is always computed first with the leading term tested for underflow before any extensive computation is done. Chebyshev expansions on appropriate intervals are used in functions AIRY and DAIRY for the Airy functions Ai(x) Ai1(x), respectively. A scaling option to remove the exponential decay for x>0 is also available. Author (ERA)

N76-24930# Sandia Labs., Albuquerque, N.Mex.
STRUCTURAL MECHANICS COMPUTER PLOTTING HANDBOOK
Z. E. Beisinger and S. E. Benzley Sep. 1975 48 p refs
(Contract AT(29-1)-789)
(SAND-75-0038) Avail: NTIS HC $5.00

Current capabilities for plotting data generated from structural analysis codes are summarized. Information concerning both the codes that generate plot commands and the machines that create the plots is presented. Instructions on obtaining both printed and plotted microfiche output are also provided. Author (ERA)

N76-24931# Sandia Labs., Albuquerque, N.Mex.
CDC 6600 SUBROUTINE FOR BESSEL FUNCTIONS
D. E. Amos and S. L. Daniel Sep. 1975 26 p refs
(Contract AT(29-1)-789)
(SAND-75-0152) Avail: NTIS HC $4.50

Subroutine BESI implements the power series, the asymptotic expansion for x yields infinity, and the uniform asymptotic expansion for v yields infinity for I/sub v/(x). For pairs (v,x) not covered by one of these formulas, v is raised by an integer (never more than 36) so that the backward recursive Miller algorithm can be normalized by one of these formulas. The order is then reduced by backward recursion on the three-term recursion relation. Sequences are also handled in this fashion, except in the region covered by the asymptotic expansion for x yields infinity and the region x < 1/2 covered by the series where two starting values are obtained from the appropriate expansion. The normalizing relation is always computed first with the leading term tested for under or over-flow, where appropriate, before any extensive computation is done. Scaled values exp(-x)I/sub v/(x) are also computed as an option. These features make the routine very robust, giving good results whenever the function value is within the exponent range of the machine. Large orders (in excess of 10,000) are possible with relative errors on the order of 10 to the -12th power. Author (ERA)

N76-24932# Sandia Labs., Albuquerque, N.Mex.
CDC 6600 SUBROUTINE FOR BESSEL FUNCTIONS
D. E. Amos and S. L. Saniel Sep. 1975 8 p refs Sponsored by ERDA
(SAND-75-0151) Avail: NTIS HC $4.00

Subroutine BESKN implements the three-term recursion relation for K/sub v/(x) in forward recursion starting with Bessel function values for two consecutive integers. If v is less than 35, k sub 0(x) and k sub 1(x) are generated for the first members of the recursion relation. If v is greater than or equal to 35, the uniform asymptotic expansion is used. The subroutine is also designed for scaled functions, exp(x)K/sub v/(x), as well as sequences of scaled or unscaled functions. Except for small orders, the leading term of the asymptotic expansion can be used to determine whether K/sub v/(x) is within the exponent range of the machine. If it is, then BESKN computes the proper value with relative errors on the order of 10 to the -12th power. Author (ERA)

N76-24933# Sandia Labs., Albuquerque, N.Mex.
USER'S GUIDE TO THE SANDIA MATHEMATICAL PROGRAM LIBRARY AT LIVERMORE
R. E. Huddleston and T. H. Jefferson Sep. 1975 88 p refs
(Contract AT(29-1)-789)
(SAND-75-8281) Avail: NTIS HC $7.50

The Sandia mathematical program library is a collection of general-purpose routines which are primarily mathematical in nature. Routines exist for the following applications: data fitting, eigenvalues and eigenvectors of matrices, Fourier transforms, linear algebraic equations, linear programming and game theory, numerical quadrature, numerical sorting, ordinary differential equations, special functions, zeros of functions and optimization, zeros of polynomials, and library error check routine and user options. Routines are listed alphabetically, with abstract and a description of parameters. ERA

N76-24934# Sandia Labs., Albuquerque, N.Mex.
APPLICATION OF THE STATE MACHINE TO DIGITAL CONTROL AND I/O INTERFACE DESIGN
D. C. Macmillan Sep. 1975 34 p refs
(Contract AT(29-1)-789)
(SAND-75-8043) Avail: NTIS HC $4.75

Two applications of the state machine concept to digital control are discussed. Algorithms and hardware are described for an analog/digital converter/computer interface and for blackjack dealer system. While the state machine is easy to debug and convenient for organizing complex tasks, it is a good choice only when time will not permit the use of a microcomputer. Author (ERA)

N76-24935# Florence Univ. (Italy). Facolta d'Ingegneria.
ALGORITHMIC PROGRAMMING SYSTEM
Gianni Aguzzi, Francesca Cesarini (CNR), Renzo Pinzani, Giovanni Soda (CNR), and Renzo Sprugnoli (Pisa Univ., Italy) 1975 22 p refs Presented at the Seminary of the Ist. di Mat. Appl.,

Florence, 26 Jun. 1975
Avail: NTIS HC $3.50

Aspects of the Algorithmic Programming System (APS) language are discussed. APS is based on some generalizations of the concept of a Normal Markov Algorithm (NMA). The NMA has two basic advantages with respect to other formal tools: it is a language the unique primitive of which is substitution and it is obviously universal. ESA

N76-24936# Air Force Weapons Lab., Kirtland AFB, N.Mex.
USER'S NOTES FOR HYDRO COMPUTER PROGRAM Final Report
P. E. Nielsen Dec. 1975 64 p refs
(AF Proj. 317J)
(AD-A018725; AFWL-TR-75-117) Avail: NTIS CSCL 09/2

The three-dimensional Eulerian hydrodynamic computer program HYDRO is discussed with the object of providing sufficient information for potential users to use and modify it in meeting their own needs. The basic program is presented, and specific examples are given of modifications used in treating problems related to laser-target interaction. Program listings and an alphabetical list of HYDRO variables are provided in Appendixes. Author (GRA)

N76-24937# Ohio State Univ. Research Foundation, Columbus. Computer and Information Science Research Center.
LANGUAGES FOR SPECIFYING PROTECTION REQUIREMENTS IN DATA BASE SYSTEMS: A SEMANTIC MODEL
H. Rex Hartson Aug. 1975 249 p refs
(Contract N00014-75-C-0573)
(AD-A018284; OSU-CISRC-TR-75-6) Avail: NTIS CSCL 09/2

This dissertation develops a model of access control to provide a semantic base for constructs of protection languages at many levels of sophistication, accommodating a wide range of protection policies. The concept of ownership is used for validation of authorizations in the model. Various ownership policies, such as group ownership, subownership, and conditional ownership can be represented. The basic sets of the model are presented and the set of system states is derived from the set of all values of the resources. GRA

N76-24938# Naval Postgraduate School, Monterey, Calif.
APPROXIMATE ANALYTICAL EVALUATION OF EXTENDED-KALMAN FILTERS M.S. Thesis
Hansan Oner Tasdelen Dec. 1975 175 p refs
(AD-A019383) Avail: NTIS CSCL 12/1

Analytical equations derived for evaluating linear estimators are applied to extended-Kalman filters for approximate performance evaluation. Two cases were considered, a single known target trajectory and multiple target trajectories with given probabilities of occurrence. For the multiple-trajectory case, equations are derived for the mean and covariance of estimation error in terms of the conditional expectations. Two examples are presented to compare the use of the analytical equations with Monte-Carlo simulation. GRA

N76-24939# Army Construction Engineering Research Lab., Champaign, Ill.
REFERENCE MANUAL FOR THE AUTOMATED MILITARY PROGRESS REPORTING SYSTEM (AMPRS) Final Report
Uldis R. Poskus and Lee Thurber Nov. 1975 427 p refs
(DA Proj. 4A7-62719-AT-01)
(AD-A018438; CERL-TR-P-49) Avail: NTIS CSCL 09/2

This reference manual for the Automated Military Construction Progress Reporting System (AMPRS) contains the Dictionary of Data Elements, Code Tables, Data Element - Report Matrix, Output Report Analysis, Residency of AMPRS Data Elements, and Sequential Table of P and C prefixed numbers. This manual is designed to assist OCE Divisions and Districts responsible for military construction in operating AMPRS. This is one of five system manuals for the AMPRS. Others are: Executive Summary for the AMPRS, USERS Manual for the AMPRS, ADP Manual for the AMPRS, and Conversion Instructions for the AMPRS. Author (GRA)

N76-24940# Army Construction Engineering Research Lab., Champaign, Ill.
USER MANUAL FOR THE COMPUTER-AIDED ENVIRONMENTAL LEGISLATIVE DATA SYSTEM Final Report
R. L. Welsh Nov. 1975 62 p
(DA Proj. 4A7-62720-A-896)
(AD-A019018; CERL-TR-E-78) Avail: NTIS CSCL 09/2

The Construction Engineering Research Laboratory (CERL) has collected federal and state laws, regulations, and standards of environmental significance. Indexing and abstracting procedures were developed, and a computer system to store and retrieve this information was implemented (Computer Aided Environmental Legislative Data System-CELDS). This report explains the data contained in CELDS and provides instructions for using the command language to communicate data needs and obtain output. Author (GRA)

N76-24941# Aerospace Corp., El Segundo, Calif. Information Processing Div.
INDUSTRIAL PRACTICES TO CONTROL CUMPUTER PROGRAM COSTS Final Report, 1 Jul. 1974 - 30 Jun. 1975
E. D. Callender 2 Jan. 1976 34 p refs
(Contract F04701-75-C-0076)
(AD-A018887; TR-0076(9320)-4; SAMSO-TR-75-293) Avail: NTIS CSCL 09/2

This report provides an overview of industrial practices that are used to control the costs of developing computer programs. Practices that are used in the area of computer program specification, generation, and test are examined. Author (GRA)

N76-24942# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
SAMSO COMPUTER LANGUAGE AND SOFTWARE DEVELOPMENT ENVIRONMENT REQUIREMENTS Final Report, 15 Apr. - 1 Jun. 1975
E. D. Callender, M. Feliciano, and L. D. Jennings 15 Dec. 1975 57 p
(Contract F04701-75-C-0076)
(AD-A018801; TR-0076(6112)-2; SAMSO-TR-75-290) Avail: NTIS CSCL 09/2

The purpose of this report is to identify the higher order language requirements and software development environment requirements for SAMSO applications. Three major sections constitute this document: (1) functional requirements for SAMSO computer programs, (2) higher order language constructs and software development environment constructs necessary to support the functional requirements, and (3) recommendations. It is technically feasible for the vast majority of all computer programming for new SAMSO projects to be done in one higher order language. If this technical feasibility is coupled with the increasing cost of software development and maintenance, standardization on a single higher order language becomes highly desirable. If cost savings in software development and maintenance are to be realized, language standardization is only part of the issue. The other main features that must be attacked and successfully resolved are the creation of a standard software development environment and the establishment of a program for the specifications, development, test, and maintenance of this single higher order language and its associated software development environment. GRA

N76-24943# RAND Corp., Santa Monica, Calif.
THE COMPUTER RESOURCE MANAGEMENT STUDY: EXECUTIVE SUMMARY Interim Report
Stephen M. Drezner, Hyman Shulman, and Willis Ware Sep. 1975 37 p
(Contract F44620-73-C-0011)
(AD-A018884; R-1855-PR) Avail: NTIS CSCL 09/2

This report summarizes the findings of a study of policy and organizational aspects of the management of Air Force computer resources. Because computer technology is relatively recent and very fast-changing, the Air Force, like many other organizations, is experiencing difficulties in managing its computer resources. This report presents an illustrative system development life cycle, which depicts an orderly process for development. Five organizational and policy actions are recommended to improve the Air Force's management of its computer resources: (1) establish an Assistant Chief of Staff for Computer Resource Management; (2) develop all computer systems through a development channel in the DCS/Research and Development

and Air Force Systems Command; (3) create a Data System Division within AFSC; (4) give each of the AFSC product divisions its own Center of Expertise; and (5) strengthen and enlarge the role of the Single Manager in all commands involved in computer system design and development. GRA

N76-24944# Army Construction Engineering Research Lab., Champaign, Ill.

USERS MANUAL FOR THE AUTOMATED MILITARY CONSTRUCTION PROGRESS REPORTING SYSTEM (AMPRS) Final Report

W. G. Guiar, J. E. Fitzpatrick, E. A. Rood, R. Skarseth, and C. J. LeBlanc Nov. 1975 252 p

(AD-A018716; CERL-TR-P-47) Avail: NTIS CSCL 09/2

This users manual presents procedures for acquiring and coding updated information for the Automated Military Construction Progress Reporting System (AMPRS). It is aimed at operations personnel in engineering, construction, and real estate who perform the acquisition and coding functions. This manual is one of five providing information and instructions for AMPRS. The other four manuals are: Executive summary for the Conversion Instruction for the AMPRS, ADP Manual for the AMPRS, Reference Manual for the AMPRS, and Converson Instructions for the AMPRS. Author (GRA)

N76-24945# Pattern Analysis and Recognition Corp., Rome, N.Y.

OCR (OPTICAL CHARACTER RECOGNITION) SOFTWARE DEVELOPMENT Final Report, Jun. 1974 - Jul. 1975

George E. Forsen and Paul C. Kane Sep. 1975 101 p refs

(Contract F30602-74-C-0309; AF Proj. 4594)

(AD-A018713; PAR-75-17; RADC-TR-75-232) Avail: NTIS CSCL 09/2

The project effort resulted in an evaluation of a correlation technique as implemented in an existing computer software program, as applied to automatic recognition of typeset printed characters which were sampled and digitized on a high-resolution scanner. Examples of Cyrillic and Latin text were extracted from several Russian technical journals. Also recorded were examples of noncharacter figures such as wood-chip and print-through blemishes, plus some graphics material. The data were edited and prepared and the results viewed on DICIFER, the RADC image-processing facility. The bulk of the correlation processing was performed using existing software (somewhat modified) from the DIMES package, and run on the RADC HIS 635 and 6180 computers. GRA

N76-24946# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. Of Computer Science.

VERIFICATION OF PROGRAMMED SYSTEMS Interim Report

Gideon Ariely Aug. 1975 313 p refs

(Contract F44620-73-C-0073)

(AD-A019536; AFOSR-75-1680TR) Avail: NTIS CSCL 09/2

A framework for verification issues of programmed systems is suggested. The framework emphasizes the use of mathematical models and the distinction between model and implementation. The implications of the general framework are explored with respect to the following: (1) Lisp-like languages; (2) Sequential Algorithms; (3) Program Structures; and (4) Parallel Systems. The thesis deals with several topics: It suggests several criteria for classifying program verification techniques, formalizes Search Algorithms, proves a representation theorem concerning Lisp-like languages, treats extensively sequential algorithms over named-structured domains, formalizes the routine concept, deals in a new fashion with parallel systems and briefly treats issues of assumptions and conventions in programmed systems. GRA

N76-24947# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

DISTRIBUTED COMPUTATION AND TENEX-RELATED ACTIVITIES Quarterly Progress Report, 1 Aug. - 30 Oct. 1975

J. Burchfiel, R. Thomas, T. Myer, and R. Tomlinson Nov. 1975 40 p

(Contract N00014-75-C-0773; ARPA Order 2901)

(AD-A018660; BBN-3210; QPR-4) Avail: NTIS CSCL 09/2

This report describes continuing refinement of the TENEX RXEXEC distributed file system which supports geography-independent computing on a number of ARPANET TENEX sites. It describes BBN efforts to integrate TENEX into the National Software Works system. It also describes BBN efforts to upgrade existing ARPANET message service to meet NAVY requirements for an interactive message processing test at CINCPAC. Author (GRA)

N76-24948# Aerospace Corp., El Segundo, Calif. Technology Div.

SOFTWARE RELIABILITY MEASUREMENT Final Report, Apr. - Jun. 1975

J. P. Johnson 8 Dec. 1975 58 p refs

(Contract F04701-75-C-0076)

(AD-A019147; TR-0076(6519)-1; SAMSO-TR-75-279) Avail: NTIS CSCL 09/2

The report contains plans for a complete software reliability measurement program using both manual and automatic data entry. The program is to be run in conjunction with SAMTEC at Vandenberg AFB in an effort to establish measurement and evaluation criteria for the advanced systematic techniques for reliable operational software (ASTROS) project. An integral part of that project is the implementation and evaluation of structured programming techniques. Included in the report are all forms necessary to describe the software development environment, the hierarchy and size of programming modules, and to capture any significant events that will affect programming and test while they are in progress. Forms and instructions for their use for manual data collection are included, as are descriptions of items that could be collected automatically. GRA

N76-24949# University of Southern Calif., Marina del Rey. Information Sciences Inst.

A KNOWLEDGEABLE, LANGUAGE-INDEPENDENT SYSTEM FOR PROGRAM CONSTRUCTION AND MODIFICATION

Martin D. Yonke Oct. 1975 70 p refs

(Contract DAHC15-72-C-0308; ARPA Order 2223)

(AD-A019334; ISI/RR-75-42) Avail: NTIS CSCL 09/2

The need of a language-independent programming environment with knowledgeable facilities is explicated. Then the design of a language-independent system for 'intelligent' creation and modification of programs as an example of such a facility. This system, called the Program Constructor and Modifier, is a two-stage process. In the first stage, an 'expert' creates a description of a programming language in a high-level formalism. This description is used in conjunction with the underlying model of programming languages to drive the second stage, in which the general user creates and modifies programs written in the particular programming language. This model will guarantee that throughout the interaction the program is syntactically error-free and -- as far as possible without executing the program -- will guarantee certain semantic consistencies. All methods associated with this model are oriented towards error prevention while still allowing the user 'free-form' program input. These methods will also automatically correct certain classes of errors such as misspelled words and omitted terminal symbols of certain types and will interact with the user to gain information when there is insufficient knowledge for automatic correction. GRA

N76-24950# Maryland Univ., College Park. Dept. of Computer Science.

PDP 11/UNIVAC 1108 CROSS ASSEMBLER SYSTEM Interim Report

W. M. Lay, A. K. Stebbens, and J. A. Pollizzi Oct. 1975 43 p refs

(Contract N00014-67-A-0239-0032)

(AD-A018678; TR-4) Avail: NTIS CSCL 09/2

This report is a user's manual for the PDP11 cross assembler and cross link-editor which runs as the Univac 1100-series machines. These programs are designed to accept source programs in the same format as the DEC programs which run on the PDP11, but with certain minor changes. Object modules produced by these programs in files on the Univac system, punched on paper tape or transmitted directly to a PDP11 connected via a data set. Author (GRA)

N76-24951# Oregon State Univ., Corvallis. School of Oceanography.

GEOPHYSICAL LIBRARY SUBROUTINES (*GLIB)

Ken Keeling, Michael Gemperle, and Gerald Connard Nov. 1975 51 p refs
(Contract N00014-67-A-0369-0007; NR Proj. 083-102)
(AD-A018736; Ref-75-20) Avail: NTIS CSCL 09/2

This report documents the various subroutines in general use by the Oregon State University Geophysics group. Included are subroutines for plotting and date and time conversion and arithmetic functions and control functions. Author (GRA)

N76-24952# Polytechnic Inst. of New York, Brooklyn. Dept. of Electrical Engineering and Electrophysics.
SUMMARY OF TECHNICAL PROCESS SOFTWARE MODELING STUDIES Interim Report, 1 Oct. 1974 - 30 Jun. 1975
Martin L. Shooman and Henry Ruston Griffiss AFB, N. Y. RADC Sep. 1975 58 p refs
(Contract F30602-74-C-0294; AF Proj. 5550)
(AD-A018618; Poly-EE/EP-75-004; RADC-TR-75-245) Avail: NTIS CSCL 09/2

During the period of time of 1 October 1974 to 30 June 1975, Polytechnic Institute of New York conducted research under RADC contract in the area of software reliability. This report presents the progress of this research. Subjects of investigation were Markov models for the prediction of software availability, theoretical models for software testing, automatic programming, automatic testing of programs and collection of error data, estimation of the initial number of program errors, program complexity and hierarchies of computable functions. GRA

N76-24953# Polytechnic Inst. of New York, Brooklyn. Dept. of Electrical Engineering and Electrophysics.
SUMMARY OF TECHNICAL PROCESS SOFTWARE MODELING STUDIES Interim Report, 1 Jul. - 30 Sep. 1974
Martin L. Shooman and Henry Ruston Griffiss AFB, N.Y. RADC Sep. 1975 36 p refs
(Contract F30602-74-C-0294; AF Proj. 5550)
(AD-A018617; POLY-EE/EP-74-019; PINY-EER-114; RADC-TR-75-246) Avail: NTIS CSCL 09/2

Polytechnic Institute of New York has conducted, under RADC contract, research in the area of software reliability. This report presents the direction in which this research is proceeding and the progress in these areas during the time period of 1 July 1974 to 30 September 1974. The areas in which this research was conducted were the modeling of software performance, identification, collection and classification of errors, and program verification. GRA

N76-24954# Naval Research Lab., Washington, D.C.
A FORTRAN PROGRAM TO PLOT PHASE SHIFTS OF THE THREE DIMENSIONAL SQUARE WELL Final Report
James L. Repace Jul. 1975 48 p
(NRL Proj. R08-42)
(AD-A019116; NRL-MR-3082) Avail: NTIS CSCL 09/2

This program calculates, and provides Cal Comp plots of, the CDC 3800 Computer, phase shifts in radians or degrees for quantum-mechanical scattering from a 3-dimensional spherically symmetrical square well potential of width a and depth -V, for a de Broglie quantum particle of energy E. The program, which can plot in two or three dimensional representations, calculates the first five phase shifts, and permits the determination of the number of bound states the well will support for each phase shift. Author (GRA)

N76-24955# Illinois Univ., Urbana. Coordinated Science Lab.
THE EFFECT OF BUFFERING PAGE FAULTED PROGRAMS IN A MULTISTREAM PIPELINED PROCESSOR M.S. Thesis
Grace Wen-Jwen Yang Dec. 1975 59 p refs
(Contract DAAB07-72-C-0259; Grant NSF GJ-40584)
(AD-A019574; R-704; UILU-ENG-75-2240) Avail: NTIS

As a general rule, a multiple-instruction multiple-data stream pipelined processor is more susceptible to page faults as the number of instruction streams in the system increases when the same primary memory is shared. The size of the primary memory then critically effects the performance of the system. As the number of instruction streams increases, more and more primary memory is generally added to the system to reduce the page fault rate. As a result, the cost of the primary memory becomes a major cost of the system. Author (GRA)

N76-24956# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
MACHINE INDEPENDENT GENERATION OF OPTIMAL LOCAL CODE Ph.D. Thesis
Joseph M. Newcomer May 1975 146 p refs
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A019571; AFOSR-75-1679TR) Avail: NTIS CSCL 09/2

There has been extensive research into the automatic generation of compilers. Much of this has concentrated on the issues of syntax and semantics, while little has been done on the problems of code generation. This thesis represents one approach to the latter problem. A model of a compiler-compiler is presented, with the research focussing on the construction of one component of the compiler, that module which determines the possible code sequences which realize a given program. The input to this component is a set of code sequences which are possible realizations of each language construct. This thesis concentrates on the automatic generation of these code sequences from a formal description of the hardware and the language. A notation is developed for representing machine instructions, and a prototype system has been constructed to demonstrate that this notation is amenable to automated analysis. Author (GRA)

62 COMPUTER SYSTEMS

Includes computer networks.

N76-24957*# Raytheon Co., Sudbury, Mass. Equipment Development Lab.
AN ENGINEERING TREATISE ON THE CARE II DUAL MODE AND COVERAGE MODELS Final Report
Apr. 1976 55 p ref Sponsored by NASA
(NASA-CR-144993; ER75-4293) Avail: NTIS HC $4.50 CSCL 09B

A mathematical model used to calculate the reliability of any dual-mode, spare-switching computer system was described, and some illustrative examples were presented. The possibility of extending the resultant computer program further was also examined, enabling it, in particular, to accomodate computer configurations involving more than two modes of operation. Author

N76-24958# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
AN EXPERIMENTAL DATA BASE FOR COMPUTER PERFORMANCE INFORMATION
P. Verstege and B. A. Wichmann Nov. 1975 83 p refs
(NPL-NAC-62) Avail: NTIS HC $5.00

An experimental data base was constructed to hold performance data. This data consists of the time taken to execute processor limited jobs written in high level machine-independent languages. The data base, the information inserted, and the analysis methods used to utilize the information are described. Author (ESA)

N76-24959# Florence Univ. (Italy). Ist. di Elettronica.
PRELIMINARY NOTES ON AN ANALOG SIGNAL ACQUISITION SYSTEM [NOTE PRELIMINARI SU UN SISTEMA DI ACQUISIZIONE DI SEGNALI ANALOGICI]
Franco Pirri 1975 18 p refs In ITALIAN
(R-1-75) Avail: NTIS HC $3.50

An automatic analog signal data acquisition and processing system is presented based on the use of the HP2100A computer and other units built at the laboratory. The system presented includes the complete software based on a modified version of BASIC augmented by subroutines written in assembly language. ESA

N76-24274 European Space Agency, Paris (France).
DESIGN AND STRUCTURE OF A UNIVERSAL DIGITAL IN-FLIGHT COMPUTER
Herbert Heins *In its* Digital Control (ESA-TT-230) Dec. 1975 p 129-139 Transl. into ENGLISH of 'Digitale Regelung u.

Steuerung', DGLR, Cologne Report DLR-Mitt-73-17, 1973 p 129-139 (For availability see N76-24267 15-08)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N76-24960# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
AVOIDING DEADLOCKS IN GENERAL AND BUFFER DEADLOCKS IN STORE-AND-FORWARD COMMUNICATION IN PARTICULAR [VERMEIDUNG VON DEADLOCKS IM ALLGEMEINEN UND VON PUFFER-DEADLOCKS BEI STORE-AND-FORWARD-KOMMUNIKATION IM BESONDEREN]
Klaus Guenther 1974 17 p refs In GERMAN
(GMD-Mitt-28) Avail: NTIS HC $3.50

The problem of avoiding deadlocks in computer processing is discussed. The problem is introduced for the general case of systems consisting of asynchronous processes. The theory developed was applied to the special case of store-and-forward communication, for which some versions of buffer deadlock avoiding methods were derived. ESA

N76-24961# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LINGUISTS: AUTOMATED CONTROL SYSTEMS
25 Nov. 1975 7 p Transl. into ENGLISH from Sovetskaya Moldaviya (USSR), no. 225 (12699), 3 Oct. 1975 p 4
(AD-A018535; FTD-ID(RS)I-2390-75) Avail: NTIS CSCL 05/7

The State Committee on Science and Technology for the Council of Ministers of the U.S.S.R. have included the development of the following problem in their coordinated plan: the development of a system of machine translation of scientific-technical texts from the major foreign languages into Russian. GRA

N76-24962# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON THE FORM OF A LIKELIHOOD RATIO FOR TWO-DIMENSIONAL RANDOM FIELDS Interim Report
Stamatis Cambanis 1975 12 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 9769)
(AD-A019533; AFOSR-75-1676TR) Avail: NTIS CSCL 09/4

It is shown that the likelihood ratio in detecting a stochastic signal in white Gaussian noise, when both the signal and the noise are two-dimensional random fields, does not have the simple exponential form of the one-dimensional case unless the signal is deterministic. This was conjectured by E. Wong where a recursive formula was derived for the likelihood ratio. Two auxiliary results of independent interest on conditional expectations are also shown. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-24963 George Washington Univ., Washington, D.C.
INFORMATION THEORETIC PROPERTIES OF SOME SPECTRAL APPROXIMATIONS IN STATIONARY TIME SERIES Ph.D. Thesis
Abdolrahman Sattarzadeh Azari 1975 111 p
Avail: Univ. Microfilms Order No. 76-10599

Spectral approximations were used to investigate certain theoretical and applied problems for the stationary Gaussian time series. The theoretical problems considered are the asymptotic sufficiency of the spectral estimates for the second-order spectra, and the generalization to the multivariate case of the results relating to the limiting discrimination information rates. The applied problems studied are linear discriminant functions, principal components and canonical correlations. Dissert. Abstr.

N76-24964*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE DAVIDON-FLETCHER-POWELL PENALTY FUNCTION METHOD: A GENERALIZED ITERATIVE TECHNIQUE FOR SOLVING PARAMETER OPTIMIZATION PROBLEMS
Ivan L. Johnson, Jr. Washington May 1976 23 p refs
(NASA-TN-D-8251; S-447) Avail: NTIS HC $3.50 CSCL 12A

The Fletcher-Powell version of the Davidon variable metric unconstrained minimization technique is described. Equations that have been used successfully with the Davidon-Fletcher-Powell penalty function technique for solving constrained minimization problems and the advantages and disadvantages of using them are discussed. The experience gained in the behavior of the method while iterating is also related. Author

N76-24965# Stockholm Univ. (Sweden).
VISUAL DESCRIPTION OF 2-COMPONENT SPINOR CALCULUS
Hans Hellsten Jul. 1975 24 p refs
(USIP-75-16) Avail: ERDA Depository Libraries HC $3.50

Spinors and algebraic operations on them are given a visual description. This structural interpretation of spinors is to be contrasted with the well known quadratic relation between spinors and visual objects (vectors, flagpoles). The interpretation is founded on the observation that the product between two successive rotations half a turn along the legs of an angle will be a rotation through twice that angle. This observation makes it possible to explain visually doubling of angles, which occurs when vectors are constructed out of spinors. It is seen that, using this explanation, spinor calculus can, in close analogy to 3-dimensional Euclidean vector calculus, be given a purely visual meaning. Author (ERA)

N76-24966# Sandia Labs., Albuquerque, N.Mex.
EXACT DIGITAL MODELS OF CONTINUOUS LINEAR SYSTEMS
Samuel D. Stearns 1975 6 p refs Presented at 9th Ann. Asilomar Conf. on Circuits, Systems and Computers, Pacific Grove, Calif., 3 Nov. 1975 Sponsored by ERDA
(SAND-75-6062; Conf-751109-5) Avail: NTIS HC $4.50

Methods are described for obtaining simulations of linear systems that are exact, i.e., free of error, for specific classes of inputs. Exact digital models of the simple geophone are used for examples. An error bound is derived for exact models used in inexact situations. Author (ERA)

N76-24967# Los Alamos Scientific Lab., N.Mex.
BAYESIAN RELIABILITY ESTIMATION: STATE OF THE ART FOR THE TIME-DEPENDENT CASE
R. A. Waller and H. F. Martz, Jr. Jun. 1975 27 p
(Contract W-7405-eng-36)
(LA-6003) Avail: NTIS HC $4.00

The four types of reliability estimation techniques considered are nonparametric, classical, Bayes, and empirical Bayes. Point and interval estimators of reliability for exponential and Weibull data are considered for the time dependent case in which the resulting estimators are functionally dependent on time. A set of exponential data is used for illustrating and comparing the different estimators. The assumptions underlying each type of estimation are given to provide an awareness of the costs and benefits associated with each technique. Author (ERA)

N76-24968# Florence Univ. (Italy). Facolta d'Ingegneria.
AUTOMATIC DISCRETIZATION OF A PLANE REGION [LA DISCRETIZZAZIONE AUTOMATICA DI UNA REGIONE PIANA]
Giorgio DAmico (Centro Ric. Autom. ENEL) 1974 22 p refs In ITALIAN Presented at the Seminary of the 1st Group of Ital. Seminaries and Math. Inst., Florence, 5 Apr. 1974
Avail: NTIS HC $3.50

An algorithm for automatic discretization of a plane area by means of triangular meshes is presented. The main requirements for an efficient algorithm are discussed. Various existing

algorithms are compared for performance. The new algorithm characteristics are detailed. ESA

N76-24969# Florence Univ. (Italy). Facolta d'Ingegneria.
ON A TOTAL STABILITY CONCEPT IN CONTINUOUS OR DISCRETE SYSTEMS [SU UN CONCETTO DI STABILITA TOTALE PER I SISTEMI DINAMICI CONTINUI O DISCRETI]
Luigi Salvadori 1974 11 p refs In ITALIAN Presented at the Seminary of the 1st Group of Ital. Seminaries and Math. Inst., Florence, 12 Jun. 1974
Avail: NTIS HC $3.50

A new concept of total stability for dynamic systems defined on a locally compact metric space is presented for continuous or discrete systems. This concept is shown to be related to the DUBOSIN stability concept when the systems considered are limited to continuous dynamic ones defined through ordinary autonomous differential equations. The asymptotic stability of a compact subset in the locally compact metric space is shown to entail the total stability of the subset. ESA

N76-24970# Aberdeen Univ. (Scotland).
ENUMERATION OF LARGE COMBINATORIAL STRUCTURES Final Technical Report, Nov. 1974 - Nov. 1975
E. M. Wright Nov. 1975 54 p refs
(Grant DA-ERO-75-G-014; DA Proj. 1T1-61102-B-18C)
(AD-A018626) Avail: NTIS CSCL 12/1

The author developed a recurrence method to obtain an exact formula for successive k for the number of graphs with n labelled nodes and N & K edges. Asymptotic results follow for large n. He also gives an account, including several new results, of the asymptotic enumeration theory for unlabelled N, Q graphs which he developed over the last few years. A detailed proof is given of results about the probability of a graph being Hamiltonian and a short account of bounds on the degrees of nodes in almost all graphs. Finally, a paper is appended on refining partitions into unequal parts which adds to results due to Erdos, Guy and Moon. GRA

N76-24971# Wisconsin Univ., Madison. Dept. of Statistics.
CORRECTING INHOMOGENEITY OF VARIANCE WITH POWER TRANSFORMATION WEIGHTING
George E. P. Box Oct. 1972 7 p refs
(Grant AF-AFOSR-2363A-72; AF Proj. 9769)
(AD-A012139; AFOSR-75-0883TR) Avail: NTIS CSCL 12/1

A method is presented for using power transformation weights in least squares analysis to account for inhomogeneity of variance. The need for this form of weighting is common. In particular it frequently arises when, as is illustrated with an example, a linearized kinetic rate expression is analyzed. GRA

N76-24972# Texas Univ., Austin. Center for Numerical Analysis.
IMPLEMENTING DEFERRED CORRECTIONS FOR NUMEROV'S DIFFERENCE METHOD FOR SECOND-ORDER TWO-POINT BOUNDARY-VALUE PROBLEMS
James W. Daniel and Andrew J. Martin Nov. 1975 88 p refs
(Contract N00014-67-A-0126-0015)
(AD-A018643; CNA-107) Avail: NTIS CSCL 12/1

The iterated deferred correction of the standard fourth-order finite difference Numerov's method for second-order two-point boundary-value problems is implemented by an improved version of the codes developed by Pereyra. The improvements are of a general nature so as to be applicable to the deferred correction of other basic schemes. While not polished enough to be called a production code, the computer code presented can be used as it stands by others or, preferably, can be used as the basis for the development of a production code suited to the needs and computer environment where it is implemented. Results of numerical experiments are described. GRA

N76-24973# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON THE FUNCTIONAL CENTRAL LIMIT THEOREM FOR MARTINGALES
Holger Rootzen Nov. 1975 20 p refs
(Contract N00014-75-C-1043)
(AD-A018701; Mimeo-Ser-1043) Avail: NTIS CSCL 12/1

Necessary and sufficient conditions for the functional central limit theorem for a double array of random variables are sought. It is argued that this is a martingale problem only if the variables truncated at some fixed point c are asymptotically a martingale difference array. Under this hypothesis, necessary and sufficient conditions for convergence in distribution to a Brownian motion are obtained when the normalization is given (i) by the sums of squares of the variables, (ii) by the conditional variances and (iii) by the variances. The results are proved by comparing the various normalizations with a 'natural' normalization. GRA

N76-24974# North Carolina Univ., Chapel Hill. Dept. of Statistics.
A MONTE CARLO STUDY OF ROBUST ESTIMATORS OF LOCATION
Raymond J. Carroll and Edward J. Wegman Nov. 1975 50 p refs
(Grants AF-AFOSR-2840-75; AF-AFOSR-2849-75; AF Proj. 9769)
(AD-A019539; Mimeo-Ser-1040; AFOSR-75-1595TR) Avail: NTIS CSCL 12/1

Andrews et al (1972) carried out an extensive Monte Carlo study of robust estimators of location. Their conclusions were that the hampel and the skipped estimates, as classes, seemed to be preferable to some of the other currently fashionable estimators. The present study extends this work to include estimators not previously examined. The estimators are compared over short-tailed as well as long-tailed alternatives and also over some dependent data generated by first-order autoregressive schemes. The conclusions of the present study are threefold. First, from our limited study, none of the so-called robust estimators are very robust over short-tailed situations. More work seems to be necessary in this situation. Second, none of the estimators perform very well in dependent data situations, particularly when the correlation is large and positive. This seems to be a rather pressing problem. Finally, for long-tailed alternatives, the hampel estimators and Hogg-type adaptive versions of the hampels are the strongest classes. GRA

N76-24975# Michigan Univ., Ann Arbor. Systems Engineering Lab.
COMPLEXITY OF VECTORIZED SOLUTION OF TWO-DIMENSIONAL FINITE ELEMENT GRIDS Technical Interim Report
D. A. Calahan Nov. 1975 37 p refs
(Grant AF-AFOSR-2815-75; AF Proj. 9749)
(AD-A019532; SEL-TR-91; AFOSR-75-1677TR) Avail: NTIS CSCL 12/1

Given a two-dimensional grid of (2 sup n)-2 rectangular finite elements with m-2 nodes/side and l variables/node, a general dissection strategy is proposed for direct solution of the associated matrix equation. Expressions are developed in terms of m, n, and l for (1) the total number of multiplications and subtractions, and (2) a tight upper bound for the number of vector operations involved. The 'average vector length' L(ave) is defined as the ratio total operations/total vectors, and is shown useful as a gross measure of vectorization efficiency. The efficiency of current vector processors in solving dissected grids is evaluated using this measure. GRA

N76-24976# California Univ., San Diego. Dept. of Mathematics.
BLOCK METHODS FOR SOLVING SPARSE LINEAR SYSTEMS Interim Report
James R. Bunch 1975 22 p refs
(Grant AF-AFOSR-2006-71; AF Proj. 9749)
(AD-A019534; AFOSR-75-1671TR) Avail: NTIS CSCL 12/1

Graph-theoretic techniques for analyzing the solution of large sparse systems of linear equations by partitioning and using block methods are developed. Questions concerning stability of block methods are discussed. GRA

N76-24977# Army Mathematics Steering Committee.
PROCEEDINGS OF THE ARMY NUMERICAL ANALYSIS CONFERENCE
Dec. 1975 563 p refs Conf. held at St. Louis, 11-12 Feb. 1975

(AD-A019431; ARO-75-3) Avail: NTIS CSCL 12/1

This is a technical report resulting from the 1975 Army Numerical Analysis and Computers Conference. It contains papers on computer aided design and engineering as well as papers on numerical analysis. GRA

N76-24978# Texas A&M Univ., College Station.
POST-STRATIFICATION ESTIMATORS AND RELATED TECHNIQUES
H. O. Hartley and Ramana Somayajulu May 1975 125 p refs
(Contracts DAHC04-69-C-0058; DAHC04-74-C-0018)
(AD-A018848; TR-15; ARO-8049.14-M) Avail: NTIS CSCL 12/1

It is the objective of this dissertation to develop techniques in current use in sample survey theory which employ auxiliary information in the form of so-called concommitant variables. The main section of this dissertation is concerned with a situation in which the auxiliary variables are used to classify the sample units into 'post strata'. In this situation the auxiliary variables will be known only after sampling and cannot be used for the construction of strata to be sampled in prescribed quotas. The second aspect is concerned with so-called 'regression estimates' and here the customary large sample theory of linear regression estimators with one concommitant variable is extended to a second order (parabolic) regression. The third aspect is concerned with extending the 'double ratio estimators' to 'multivariate double ratio estimators' and the well known 'linear regression estimators' to 'linear regression estimators with several auxiliary variables'. GRA

N76-24979# Siam Inst. for Mathematics and Society, Philadelphia, Pa.
THE ANALYSIS OF CYCLIC POINT PROCESSES WITH WALSH FUNCTION Final Report
Walter S. Liggett, Jr. Sep. 1975 48 p refs
(Contract N00014-74-C-0432; NR Proj. 042-327)
(AD-A018893) Avail: NTIS CSCL 12/1

Transformation by Walsh functions is a technique useful for uncovering the interactions among the daily, weekly, and seasonal cycles often present in societal data. The structural and sampling properties needed for interpretation are simple, the former because Walsh functions are easy to visualize, the latter because the normal approximation applies whenever the total number of events is large. This paper demonstrates these properties, extends this technique to multivariate point processes, and discusses display of the counting function, a technique which complements the Walsh transform. These techniques are illustrated by applying them to a series of robberies. Author (GRA)

N76-24980# Sandia Labs., Albuquerque, N.Mex.
SOLVING SYSTEMS FOR NONLINEAR EQUATIONS
L. F. Sampine and M. K. Gordon Aug. 1975 25 p refs
(Contract AT(29-1)-789)
(SAND-75-0450) Avail: NTIS HC $4.00

The problem of obtaining roots of systems of nonlinear equations is considered. Some methods are discussed along with some of their more obvious difficulties and relative merits. The basic ideas of the code QN are presented. Details of the implementation are included for reference. Some numerical experiments are described to place the performance of the code in perspective. Author (ERA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-24981 Cornell Univ., Ithaca, N.Y.
MODELS FOR STATISTICAL DIAGNOSIS Ph.D. Thesis
Gerald Andrew Shea 1975 114 p
Avail: Univ. Microfilms Order No. 76-9563

The application of Bayes procedures to biological diseases and mechanical defects that have a dynamic, changing structure is discussed. Previous methods have dealt almost exclusively with fixed abnormal states represented by random variables defined on a lattice of points. Here the abnormalities are divergences from a common norm and the 'random variables have support on a convex set. The latter approach has intuitive appeal when the observations have continuous distributions. Applications to continuous control and to early diagnosis are noted. Within the framework of the convex support model, a class of signs is introduced with a desirable diagnostic property. If the lattice support model is used, symptoms in this class will be positively or negatively dependent; for such observations, conditional independence is equivalent to conditional pair-wise uncorrelatedness. Dissert. Abstr.

N76-24982# Florence Univ. (Italy). Ist. di Ingegneria Civile.
ON STRUCTURAL RELIABILITY UNDER TIME-VARYING MULTI-PARAMETER LOADING
Giuliano Augusti 1975 15 p refs Presented at the 3rd Intern. Conf. on Struct. Mech. in Reactor Technol., London, 1-5 Sep. 1975 Sponsored by CNR
(UFIST/02/1975) Avail: NTIS HC $3.50

A general formulation of the problem of expressing loads acting on a structural system for the calculation of reliability is proposed. Noting that the general formulation is not always applicable, special procedures are presented according to the type of loads and structural response. Various examples are discussed with regard to the superimposition of loads having different origin and characteristics. It is shown that in the case of impulsive loads the statistics of extreme values must be supplemented, for superimposition studies, with the instantaneous probability distributions of the load intensities. ESA

N76-24983# Wyoming Univ., Laramie. Statistics Lab.
A NONRANDOMIZED UNCONDITIONAL TEST FOR COMPARING TWO PROPORTIONS
Lyman L. McDonald, Bruce Davis, and George A. Milliken Oct. 1975 68 p refs Prepared in cooperation with Kansas State Univ.
(Contract N00014-75-C-0515; NR Proj. 042-310)
(AD-A018710; S-1975-543) Avail: NTIS CSCL 12/1

It is shown that the 'usual' nonrandomized, conditional test for comparing proportions using independent binomial samples, is very conservative in the sense that the actual significance level attributable to an outcome is often one-fourth to one-half of the anticipated value. A nonrandomized unconditional test is proposed, and for sample sizes up to 20, tables are given which specify one-sided critical regions of size less than or equal to the nominal values 0.10, 0.05, 0.025, 0.01, and 0.005 (two-sided critical regions are also given). Numerical examples illustrating the use of the tables are included. GRA

N76-24984# North Carolina Univ., Chapel Hill. Dept. of Statistics.
A NOTE ON CONVERGENCE TO MIXTURES OF NORMAL DISTRIBUTIONS
Holger Rootzen Dec. 1975 11 p refs
(Contract N00014-75-C-0809)
(AD-A018799; Mimeo-Ser-1045) Avail: NTIS CSCL 12/1

Double arrays of random variables obtained by normalizing a sequence that is asymptotically close to a martingale difference sequence are considered, and conditions ensuring that the row sums converge in distribution to a mixture of normal distributions are found. The main condition is that the sums of squares in each row converge in probability to a random variable. GRA

N76-24985# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LINEAR STATISTICAL REGRESSION AND FUNCTIONAL RELATIONS Final Report
Frank E. Grubbs Nov. 1975 55 p refs
(DA Proj. 1T1-61102-A-14B)
(AD-A018651; BRL-1842) Avail: NTIS CSCL 12/1

An approach to linear least squares or regression with errors of measurement in either one or both variables is covered, giving a computationally convenient procedure for all of the appropriate statistical significance tests or tests of hypotheses concerning the true unknown parameters and the fitted line. The problem of meaningful physical functional relations is also discussed, showing the relation to and a comparison with usual least squares.

Pertinent examples illustrating various applications of the theory are also given. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-24986 Cornell Univ., New York.
THE EFFICIENT HIGH-SPEED TIME-DOMAIN COMPUTER SIMULATION OF LINEAR SYSTEMS Ph.D. Thesis
Cary Chia Lih Tan 1975 181 p
Avail: Univ. Microfilms Order No. 76-9570

A high-speed transient analysis computer algorithm LNSTIF incorporating stiffly stable variable-stepsize integration formulas of orders 1 through 6 and a sparse parallel system representation was presented. The class of problems to which LNSTIF applies includes simulation of pulse-forming circuits, pulse transmission systems, delay networks, transmission line equalizers and video coupling systems, all with widely separated natural frequencies. LNSTIF is written in FORTRAN IV as a self-contained subroutine which does neither reading nor printing. System poles are optimally assigned in pairs to second-order subsystems. A zero-order formula is introduced to bypass calculation in a subsystem when it has practically reached its steady state. To maximize integration stepsize each subsystem chooses among the integration orders 0 through 6 and integrates with its best order. A method of generating a set of stationary sampled Gaussian processes with specified cross- and autocorrelation functions was also discussed. Dissert. Abstr.

N76-24987# California Univ., Los Angeles. School of Engineering and Applied Science.
QUEUEING NETWORK MODELS FOR COMPUTER SYSTEMS Ph.D. Thesis
J. W.-N. Wong Jun. 1975 255 p refs
(Contract DAHC15-73-C-0368)
(AD-A018657; UCLA-ENG-7579) Avail: NTIS CSCL 09/2

Queueing network models are used for performance studies of computer systems. The basic model under consideration is a closed network representing N terminal users competing for the use of a set of processing resources. With the assumption that all users are statistically identical, asymptotic expressions are derived for performance measures such as resource utilization and mean response time when N is large. These expressions characterize the behavior of the system as N increases. They have the important advantages that (1) they are simple functions of the model parameters, and (2) they apply to models that do not yield to exact analysis. For the basic model, formal definitions are also given to terms like limiting resource, system saturation, and system balance. A limited memory model is then used to study the effect of memory limitations on the asymptotic properties of resource utilization and mean response time. GRA

N76-24988# Decisions and Designs, Inc., McLean, Va.
ISSUES IN THE VALUE OF DECISION ANALYSIS Technical Report, 10 Jan. 1975 - 9 Jan. 1976
Stephen R. Watson (Cambridge Univ.) and R. V. Brown Nov. 1975 56 p refs
(Contract N00014-75-C-0426; NR Proj. 197-029)
(AD-A019339) Avail: NTIS CSCL 12/2

This paper explores methodological issues, especially logical and mathematical, in putting a dollar value to a proposed decision analysis exercise. It restricts attention to the direct value of the analysis in terms of impact on the decision analyzed. It disregards indirect values or costs the analysis may have, however important these may be in enhancing organizational processes. Two alternative valuation instruments are identified, expressed in explicit mathematical form. GRA

N76-24989# California Univ., Berkeley. Operations Research Center.
A DYNAMIC THEORY OF PRODUCTION CORRESPONDENCES
Ronald W. Shephard and Rolf Fare (Lund Univ., Sweden) Sep. 1975 108 p refs
(Contract N00014-76-C-0134; Grant NSF MPS-74-21222; NR Proj. 047-033)
(AD-A019527; ORC-75-13) Avail: NTIS CSCL 12/2

A dynamic theory of production correspondences is formulated, first abstractly as mappings between function spaces and second as an activity analysis model related to a directed graph defining exogenous inputs, intermediate product and net output transfers. By introducing time variable technical coefficients and time lags, the activity analysis model is given specific form with illustrations of computations. GRA

N76-24990# California Univ., Los Angeles. Graduate School of Management.
EFFECTS OF SECURITY MEASURES ON NETWORK PERFORMANCE
Bennet P. Lientz and Ira R. Weiss Nov. 1975 26 p refs
(Contract N00014-75-C-0266; NR Proj. 049-345)
(AD-A018762) Avail: NTIS CSCL 09/2

The effect of imposing security measures on centralized, semi-centralized and distributed networks is examined in terms of trade-offs based on workload, response time, and cost. A variety of percentages of secure workload and levels of degradation are considered. GRA

N76-24991# Maryland Univ., College Park. Dept. of Computer Science.
AN OVERVIEW OF THE DISTRIBUTED COMPUTER NETWORK
David L. Mills Oct. 1975 68 p refs
(Contract N00014-67-A-0239-0032; Grant NSF GK-41602)
(AD-A018734; TR-413) Avail: NTIS CSCL 09/2

The Distributed Computer Network (DCN) is a resource-sharing computer network which includes a number of DEC PDP11 computers. The DCN supports a number of processes in a multiprogrammed distributed environment. Processes can communicate with each other and interface with their environment in a manner which is independent of their residence within a particular computer. Resources such as processors, devices and storage media can be remotely accessed and shared so as to provide increased reliability, flexibility and system utilization. The DCN now supports several programming languages and applications packages. Common programming languages such as LISP, BASIC and others, along with an extensive library of interactive graphics procedures, can be executed in processes which take full advantage of the distributed architecture of the system. Most of the components of the Disk Operating System (DOS) for the PDP11 can be executed in a special emulator-type virtual process now being constructed for this purpose. GRA

N76-24992# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
SEMANTIC MODELS FOR PARALLEL SYSTEMS Interim Report
Ellis S. Cohen Jan. 1975 34 p refs
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A019661; AFOSR-75-1675TR) Avail: NTIS CSCL 09/2

This paper presents a semantic model for parallel systems with a scheduling mechanism that is useful for expressing and proving a wider range of properties than semantic models which do not consider scheduling. We formally describe a number of properties related to scheduling and deadlock, including 'Fairness' and 'Fullness', and show that schedulers with these properties behave in desirable ways. Lastly, we prove and conjecture some proof rules for scheduled systems and outline briefly the relation of this work to modelling protection in parallel systems. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-24993# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
ON DUAL SPACES OF NOT NECESSARILY LOCALLY CONVEX FUNCTION SPACES [UEBER DUALRAEUME NICHT NOTWENDIG LOKALKONVEXER FUNKTIONENRAEUME]

Gustav Zahel 1975 37 p refs In GERMAN Sponsored in part by Budesmin. fuer Forsch. u. Technol. and Landesamt fuer Forsch. des Landes Nordrhein-Westfalen
(BMFT-GMD-102) Avail: NTIS HC $4.00; Ges. fuer Math. und Datenverarbeitung DM 7

A certain class of function spaces, containing the space discussed by Gramsch and Nakano, is presented. A criterion proposed by Cater is generalized so that from the construction of the space it can be seen whether or not the related dual space is trivial. Within limits it is possible to give for the nontrivial steady linear functionals a measure theoretical meaning. It is shown that for the case of sigma-finite nonatomic measure spaces <sub phi, via a n-dimensional Euclidic space to the function space under discussion - similar to the Sobolev chain - a sequence of so-called 'derived spaces' can be formed. Finally the relationships existing between locally convex or nearly locally convex spaces and properties of compact convex partial collections are discussed. ESA

N76-24994# Utah Univ., Salt Lake City. Dept. of Mathematics.
SPECTRAL ANALYSIS OF THE EPSTEIN OPERATOR
J. C. Guillot and C. H. Wilcox Aug. 1975 106 p refs
(Contract N00014-67-A-0325-0006; NR Proj. 041-370)
(AD-A019043; TSR-27) Avail: NTIS CSCL 12/1

The Epstein operator is defined and applied to the study of acoustic wave propagation in a plane-stratified fluid. It is shown that the operator defines a selfadjoint operator in a Hilbert space. The spectral family of the Epstein operator is constructed; the spectrum is shown to be continuous; and an eigenfunction for the operator is given in terms of improper eigenfunctions. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-24995*# General Electric Co., Cincinnati, Ohio.
OPTIMIZATION OF SUPPRESSION FOR TWO-ELEMENT TREATMENT LINERS FOR TURBOMACHINERY EXHAUST DUCTS Final Report, Aug. 1974 - Dec. 1975
R. E. Motsinger, R. E. Kraft, J. W. Zwick, S. I. Vukelich, G. L. Minner, and K. J. Baumeister Apr. 1976 132 p refs
(Contract NAS3-18555)
(NASA-CR-134997; R76AEG256) Avail: NTIS HC $6.00 CSCL 20A

Sound wave propagation in a soft-walled rectangular duct with steady uniform flow was investigated at exhaust conditions, incorporating the solution equations for sound wave propagation in a rectangular duct with multiple longitudinal wall treatment segments. Modal analysis was employed to find the solution equations and to study the effectiveness of a uniform and of a two-sectional liner in attenuating sound power in a treated rectangular duct without flow (M = 0) and with uniform flow of Mach 0.3. Two-segment liners were shown to increase the attenuation of sound as compared to a uniform liner. The predicted sound attenuation was compared with measured laboratory results for an optimized two-segment suppressor. Good correlation was obtained between the measured and predicted suppressions when practical variations in the modal content and impedance were taken into account. Two parametric studies were also completed. Author

N76-24996# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
SOUND AMPLIFICATION AND NOISE REDUCTION USING THE LOCKING PRINCIPLE FOR INDUCED RHYTHMIC VORTEX FLOWS EXEMPLIFIED FOR SENSITIVE FLAMES [SCHALLVERSTAERKUNG UND GERAEUSCHMINDERUNG MIT HILFE DES MITNAHMEPRINZIPES BEI BEEINFLUSSTEN RHYTHMISCHEN WIRBELSTROEMUNGEN DARGESTELLT AM BEISPIEL SENSIBLER FLAMMEN]
Peter E. M. Schneider Oct. 1975 64 p refs In GERMAN
(Rept-10/1975) Avail: NTIS HC $4.50; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 14.65

Morphologic events in flows related to acoustic and noise radiation thereof are exemplified for sound-sensitive free jet flames. This makes it possible to determine the sound spectrum of turbulent flow resulting from superposition of more or less periodic vortex formation and vortex transformation. An historic survey is presented of research concerned with sound-sensitive premixed and diffusion flames. Results are described of investigations relating to the amplification of an irradiating sound signal by a flame and the sound damping of a turbulent flame using an irradiating sound signal. The interpretation of the spectrum of flame-radiated sound shows that rhythmic vortex flows can be described by self-excited flowing oscillatory systems, which can be controlled by the locking principle. ESA

N76-24997# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
PHASE MODULATION OF ULTRASONIC WAVES BY WATER FLOW Thesis - Goettingen Univ., West Ger. [PHASEN-MODULATION VON ULTRASCHALLWELLEN DURCH WASSERSTROEMUNGEN]
Horst Stiewitt Oct. 1975 196 p refs In GERMAN
(Rept-11/1975) Avail: NTIS HC $7.50; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 41.55

The ultrasonic measurement of water flow velocity is discussed, in particular by the observation of phase variations. The effect of sound velocity variations upon ultrasonic wave propagation is discussed using simple models, and resulting phase variations of the ultrasonic wave are calculated. An ultrasonic measurement chain is described, and two methods for phase demodulation are elaborated. Applications are shown for the probeless measurement of certain flows. A calibration test is described in which the measured phase variations are compared with those determined theoretically for a defined velocity variation. A turbulent free jet is shown to have a close relation between phase and amplitude modulation. A laser analog is described with crossed ultrasonic beams. This should allow probeless measurement of component-wise velocity variations. ESA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-24998 Pennsylvania State Univ., University Park.
MOLECULAR BEAM SCATTERING FROM CLEAN SURFACES OF ALKALI HALIDES Ph.D. Thesis
Jeffrey Alan Meyers 1975 97 p
Avail: Univ. Microfilms Order No. 76-10764

Molecular beam scattering of light gases from in situ cleaved alkali halide surfaces was studied as a means of obtaining information about the gas atom-solid surface potential interaction. For He scattering LiF carried out under improved resolution the main results are as follows: (1) There are four bound states in the surface potential well, at energies of -5.8, -2.2, -0.6 and -0.1 meV. (2) Most of the structure designated as fine structure is due either to transitions to these four levels via various small reciprocal lattice vectors or to the opening of diffraction channels. (3) The transitions involving the [01] reciprocal lattice vectors (i.e., the ones nearly perpendicular to the incident wavevecto r) are strong; as much as 85% of the specular intensity may be removed. Dissert. Abstr.

N76-24999# Central Electricity Generating Board, Berkeley (England).
USERS MANUAL FOR THE ELECTRON TRANSPORT CODE ETRAN
D. M. Johnson Apr. 1975 17 p
(RD/B/N-3325) Avail: ERDA Depository Libraries HC $4.50

The FORTRAN 4 electron transport code ETRAN was mounted on the IBM System 370. This one-dimensional Monte Carlo program can handle primary sources of electrons or photons and all interaction mechanisms are followed extremely accurately. The limited geometry options mean the code does not have wide application, but is designed primarily for investigation of specific interactions or as a standard for the development of more general codes. A users guide is given together with probable values of fundamental program parameters necessary in the applications likely to be encountered. Indications are given as to how efficiency can be improved for a particular problem, as running times tend to be long. Author (ERA)

N76-25000# City Coll. of the City Univ. of New York. Dept. of Physics.
LOW ENERGY SCATTERING OF ATOMS BY ATOMS OR MOLECULES, 1. RELATIVISTIC EFFECTS IN ATOMS, 2. LASER-ATOM INTERACTIONS, 3 Final Report, Jul. 1972 - Sep. 1975
M. H. Mittleman 1975 7 p refs
(Contract N00014-72-A-0406-0004)
(AD-A019441; FR-10) Avail: NTIS CSCL 07/4

This very brief report covers scientific research in three areas: low energy scattering of atoms by atoms or molecules; relativistic effects in atoms; and, laser-atom interactions. GRA

N76-25001# ARO, Inc., Arnold Air Force Station, Tenn.
COLLISIONAL QUENCHING OF ATOMIC AND MOLECULAR NITROGEN: 1. EXPERIMENTAL RESULTS Final Report, 1 Jul. 1973 - 30 Jun. 1975
L. L. Price and J. W. L. Lewis AEDC Dec. 1975 38 p refs
(ARO Proj. VF420; ARO Proj. V32S-46A)
(AD-A018780; ARO-VKF-TR-75-111; AEDC-TR-75-151) Avail: NTIS CSCL 20/10

High energy electron beam collisions with N2 have been used to produce various fluorescent emission systems, the intensities of which were investigated over the approximate pressure range of 0.1 to 2.0 torr at both 300 and 94 K. Specifically, the intensities of the N2(-) first negative system, the 493.5-nm N line, and the 500.5-nm N- line were observed as a function of N2 pressure, and the results were used to determine the quenching rate constants for these excited electronic states. Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-25002 Mississippi Univ., University.
APPLICATION OF MONTE CARLO TECHNIQUES IN THE ANALYSIS OF LASER INDUCED MICRO-FISSION EXPLOSIONS Ph.D. Thesis
Richard Raspet 1975 99 p
Avail: Univ. Microfilms Order No. 76-11738

Monte Carlo techniques were used to study various aspects of laser induced fission. A velocity code is used to determine the critical dimensions of bare spheres of U-235 and Pu-239 which have been laser imploded to ultra-high densities. These results are employed to determine both the relative suitability of these elements as fuels for laser induced fission and the feasibility of laser induced fission as a source of commercial energy. A more sophisticated code has been used to study the effects of a neutron reflecting layer in reducing the laser energy requirements. Hydrogen, a tritium-deuterium mixture and beryllium have been investigated as possible neutron reflecting materials. The maximum reduction in the laser energy requirement has been determined for each of the three reflecting materials over a wide range of neutron multiplication rates. The reduction in laser energy is found to be significant if a strong initiator is employed. Dissert. Abstr.

N76-25003# Addis Translations International, Portola Valley, Calif.
MECHANISM OF ENHANCEMENT OF CONTROLLABLE SECONDARY-ELECTRON EMISSION FROM FAST SINGLE ELECTRONS
M. P. Lorikyan, R. L. Kavalov, N. N. Trofimchuk, A. N. Arvanov, and V. G. Gavalyan Nov. 1975 30 p refs Transl. into ENGLISH from Russian Report EFI-131 (75) Sponsored by ERDA
(SLAC-Trans-170; EFI-131(75)) Avail: NTIS

For porous KCl films (density approximately 2 percent, thickness 50-400 mu m), the controllable secondary electron emission (CSEE) from fast single electrons with energies of 0.7-2 MeV was studied. An electric field E was set up inside the porous films and the emission curves anti sigma equals f(E) and the energy spectra of the secondary electrons were measured. The mean emission coefficient anti sigma increases with increasing E. Internal enhancement of CSEE under the action of the E field is explained by a process similar to the Townsend semi-self-maintained discharge in gases. The mean free path L/sub e/ of the secondary electrons estimated on the basis of this mechanism of CSEE enhancement is in good agreement with the L/sub e/ value obtained independently from the energy spectra of the secondary electrons. The possibility of using films in particle detectors is discussed. Author (ESA)

N76-25004# Siemens A.G., Erlangen (West Germany). Abteilung Technische Physik.
SUPERCONDUCTING SYNCHROTRON MAGNETS Final Report [SUPRALEITENDE SYNCHROTRONMAGNETE]
Herbert Salzburger Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 147 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-25) Avail: NTIS HC $6.00; ZLDI, Munich DM 30,90

A prototype superconducting synchrotron magnet with a cold aperture of 80 mm, a magnetic length of 450 mm, and a cold iron yoke was constructed. It attained a current of 618 A after training in 100 steps and generated 3.7 T central flux density with an homogeneity of 2% in the cylindrical space of 100 mm axial length and 40 mm diameter. Several computer programs for the design of elliptical windings are outlined and manufacturing, geometrical, mechanical, and electrical aspects of braided conductors are discussed. A study was made of the behavior of the iron yoke at 4.2 K and a description is given of tests carried out on structural materials and on different techniques with regard to windings and impregnation. Author (ESA)

N76-25005# Florence Univ. (Italy).
NEUTRON TRANSPORT IN A SLAB WITH MOVING BOUNDARIES
Aldo Bellini-Morante and Ruggero Farano (Camerino Univ., Italy) 1975 13 p refs Presented at the Seminary of the Ist. di Mat. Appl., Florence, 4 Mar. 1975
Avail: NTIS HC $3.50

The theory of semigroups is used to prove the existence and the uniqueness of a positive solution (belonging to a suitable Hilbert space X) of a monoenergetic neutron transport problem in a slab with time dependent half thickness a = a(t). The theory is also used to find some asymptotic properties of the solution of the transport problem. The problem is connected with nuclear reactor safety. ESA

N76-25006# Montpellier Univ. (France). Dept. de Physique Mathematique.
INCLUSIVE ELECTROPRODUCTION OF HADRONS
J. Layssac Jan. 1976 18 p refs
(PM/76/1) Avail: NTIS HC $3.50

The inclusive processes ep leads to e'p'X and ep leads to e' negative positive pion X are studied on the basis of Regge exchange mechanisms. Some implications for pion structure functions are discussed. Author (ESA)

74 OPTICS

Includes light phenomena.

N76-25007 Pennsylvania State Univ., University Park.
POTENTIALITIES OF ELLIPSOMETRY Ph.D. Thesis
Mark Malin 1975 108 p
Avail: Univ. Microfilms Order No. 76-10757

A new numerical method of determining all the optical constants of an absorbing film, absorbing substrate system, has been developed. The success of this algorithm depends on the numerical inversion of the exact Drude equations. The film thickness was expressed as a complex function of the refractive indices and extinction coefficients of the film and substrate and of the experimentally measured ellipsometric parameters. A scan over the various unknown parameters, using the numerical method, allows us to locate points which satisfy this equation for one set of two measurements. A FORTRAN IV program has been written to carry out the above numerical method. The generality and validity of the algorithm has been thoroughly investigated for different ideal cases. In addition the effects of the actual limited precision of ellipsometric measurements have been studied and the results presented. The potentialities of ellipsometry for characterization of transparent materials have also been investigated. Dissert. Abstr.

N76-25008 Arizona Univ., Tucson.
A METHOD FOR DETERMINING THE OPERATIONAL IMAGING PERFORMANCE OF ORBITAL EARTH RESOURCES SENSORS Ph.D. Thesis
Robert Alan Schowengerdt 1975 184 p
Avail: Univ. Microfilms Order No. 76-11311

A technique, called Scale Matching Analysis (SMA), which is particularly applicable to measurements of the optical transfer function (OTF) of orbital earth resources sensors is presented. A comparison of SMA to an established technique for OTF measurements, Edge Gradient Analysis (EGA) is included along with a mathematical derivation of the noise in OTF, as calculated by each method. Sensitivity of the OTF calculated by SMA to errors in the analysis is evaluated by the introduction of artificially generated errors of known magnitude. The SMA is applied to two different scenes, one urban and the other desert, and the OTF's are compared. The noise in the OTF is measured for both EGA and SMA, and compared with mathematical predications. Results are summarized and conclusions are drawn.
Dissert. Abstr.

N76-25009# JENAER Glaswerk Schott and Gen., Mainz (West Germany).
ATHERMAL OPTICAL ELEMENTS AND SYSTEMS Final Report [TEMPERATURUNABHAENGIGE OPTISCHE ELEMENTE UND SYSTEME]
Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 55 p refs In GERMAN; ENGLISH summaries Sponsored by Bundesmin. fuer Forsch. u. Technol. Prepared jointly with Carl Zeiss
(BMFT-FB-T-75-43) Avail: NTIS HC $4.50; ZLDI, Munich DM 11.55

Athermal optical glasses were developed which exhibit reduced thermal wave aberrations compared to classical glasses. New telescope objectives were designed and manufactured based on these glasses. The improvement in temperature behavior compared to conventional objectives is remarkable. For individual titles, see N76-25010 through N76-25011.

N76-25010 JENAER Glaswerk Schott and Gen., Mainz (West Germany).
DEVELOPMENT OF NEW OPTICAL GLASSES FOR THE CONSTRUCTION OF ATHERMAL OPTICAL ELEMENTS AND LENS SYSTEMS
F. Reitmayer and M. Faulstich *In its* Athermal Opt. Elem. and Systems Dec. 1975 p 7-20 ref In GERMAN; ENGLISH summary (For availability see N76-25009 15-74)

Temperature gradients which are caused by partial heating in optical elements may result in wave aberrations. Athermal optical glasses were developed. Compared to the classical glasses, the new athermal glasses exhibit thermal wave aberrations which are considerably reduced. Author (ESA)

N76-25011 Zeiss (Carl), Oberkochen (West Germany).
ATHERMAL LENS SYSTEMS
H. Koehler and F. Straehle *In its* Athermal Opt. Elem. and Systems Dec. 1975 p 21-55 refs In GERMAN; ENGLISH summary (For availability see N76-25009 15-74)

The theory of thermal defocussing of lens systems is discussed and conditions relating to athermal objectives are derived. New telescope objectives were designed which are insensitive to radial temperature gradients using athermal optical glasses, and three prototypes were manufactured. The objectives were tested by ray tracing and by experiments. The improvement in the temperature behavior compared to conventional objectives is remarkable. Author (ESA)

N76-25012# Recherches et Etudes d'Optique et de Sciences Connexes, Ballainvilliers (France).
FABRICATION OF OPTICAL COMPONENTS FOR SPACECRAFTS [FABRICATION DES COMPOSANTS OPTIQUES DES ENGINS SPATIAUX]
J. L. Mercier [1975] 9 p ref In FRENCH; ENGLISH summary
Avail: NTIS HC $3.50

Problems in fabrication of aspherical and large aperture mirrors for spacecraft are discussed. For a concave mirror the main parameters defining an aspherical mirror are reviewed: aperture ratio, deformation from best fit sphere, and optical accuracy. A plot of actual accuracy versus figuring difficulty is described. The need to use non rigid optical tools with special shapes for aspherical surface figuring is stressed. Direct measurement of the angular error on the wavefront is made by the Hartmann test. Angular errors on the mirror measured along the mirror allow computation of the energy concentration in a circle of given diameter. ESA

N76-25013# Utah State Univ., Logan. Electro-Dynamics Lab.
SIMS INTERFEROMETER STUDY Final Report, 1 Feb. 1974 - 30 Jun. 1975
Roy W. Esplin, Doran J. Baker, and Ronald J. Huppi Hanscom Air Force Base, Mass. AFCRL 31 Jul. 1975 45 p refs
(Contract F19628-74-C-0100; DNA Proj. NWET-L25AAXHX632)
(AD-A018787; AFCRL-TR-75-0500) Avail: NTIS CSCL 17/5

The operation and potential uses of a new type of infrared interference spectrometer were studied. The spectrometer selectively modulates one wavelength at a time. The spectrometer forms interference fringes from two laterally displaced images of the source. These interference fringes are the Fourier transform of the source spectrum. The inverse Fourier transform can be accomplished (the source spectrum recovered) by vibrating a grill across the fringes as the amount of lateral displacement of the source images is varied. Since one spectral element is recovered for each amount of lateral image displacement, the spectrometer is called a selective modulation interference spectrometer (SIMS). The spectrometer can also be used as a spectrally tuneable radiometer by setting the amount of lateral displacement to recover the desired wavelength. The SIMS can be designed to have a large throughput without sacrificing resolution. This characteristic is the most important advantage of the SIMS over other spectrometers. GRA

N76-25014# Raytheon Co., Waltham, Mass. Research Div.
HARDENED CVD ZINC SELENIDE FOR FLIR WINDOWS Final Technical Report, 29 Apr. 1974 - 29 Apr. 1975
Robert N. Donadio, Alan W. Swanson, and James Pappis Wright-Patterson AFB, Ohio AFML Sep. 1975 81 p
(Contract F33615-74-C-5145; AF Proj. 7371)
(AD-A018682; S-1884) Avail: NTIS CSCL 17/5

The significance of this exploratory development program to the Air Force is the demonstration that the CVD process can be used to increase the hardness of optical materials such as zinc selenide and sulfide by the use of dopants such as aluminum and silicon. Increases in Knoop hardness of 50 to 100 percent were realized, although some degradation in optical properties was noted, particularly at visible wavelengths. It was also demonstrated that the CVD process can be used to deposit a thin adhering layer of zinc sulfide or hardened sulfide or selenide to a polished zinc selenide substrate. Close to theoretical

transmittance was achieved. Composite structures were also fabricated by adhesively bonding polished thin layers onto a zinc selenide substrate. In this case, the transmittance was limited by internal reflectance and impurity absorptions of the adhesive. Further work on this concept is required before usable hardware is attained. GRA

N76-25015# Army Engineer Topographic Labs., Fort Belvoir, Va.
MAP ILLUMINATOR TEST, PHASE 1 Final Report
Leonard R. Tavernetti, Leroy J. Morkes, and R. J. Orsinger Sep. 1975 56 p
(AD-A019443; ETL-0034) Avail: NTIS CSCL 13/1

The document presents the results of an experiment conducted on the utility of four experimental devices for reading maps at night. The experimental devices employ white light at a low level together with a light control film and are intended for use in the field at night. The standard military flashlight with a red filter is used for control. Ten officers were dark-adapted, asked to read a variety of topographic line and photo maps, and timed on their ability to recover their night vision after using the devices. None of the devices permitted the user to read all the details of a map. The flashlight had significantly more effect on the night vision of the users than did the map illuminators. The experiment demonstrated that the mean error on map reading at night was over 40 percent and that Model D of the map illuminators was the best device tested for night map reading. GRA

N76-25016# Naval Electronics Lab. Center, San Diego, Calif.
OPTICAL MATRIX-VECTOR MULTIPLICATION AND TWO-CHANNEL PROCESSING WITH PHOTODICHROIC CRYSTALS Ph.D. Thesis
Richard Perry Bocker 1 Dec. 1975 193 p refs
(AD-A019432; NELC/TD-458) Avail: NTIS CSCL 20/6

This dissertation deals with two optical methods for data processing. The first method works with incoherent light. It is based on optical analog methods developed by Bromley in 1974 for performing the operations of correlation and convolution. This method yields the product of a two-dimensional matrix operator on a one-dimensional input column vector. The second method works with coherent light. The processing is performed by spatial frequency filters. The approach parallels that of Marathay, who, in 1969, laid the theoretical foundation for the realization of real bipolar and complex spatial filters for two-channel coherent optical processing using the polarization discrimination properties of Vectograph film. A photodichroic crystal was chosen for the recording medium because it has the feature that information can be recorded with light of one wavelength and nondestructively read out with light of a longer wavelength. In addition, such crystals can be recycled through many write, read, and erase operations, making them ideally suited as an active optical processing medium. This investigation shows that a single photodichroic crystal between crossed linear polarizers can be used to record real bipolar filter information. Similarly, two photodichroic crystals combined with a quarter-wave plate could be used between crossed linear polarizers for the synthesis of a complex filter. GRA

N76-25017# Naval Postgraduate School, Monterey, Calif.
AN APPROACH TO THE ESTIMATION OF LIFE CYCLE COSTS OF A FIBER-OPTIC APPLICATION IN MILITARY AIRCRAFT M.S. Thesis
John Michael McGrath and Kenneth Ralph Michna Sep. 1975 163 p refs
(AD-A019379) Avail: NTIS CSCL 20/6

As significant technological advances in fiber optics and optical data transmission methods are being made, it is necessary to develop appropriate methods for estimating life cycle costs for alternative coaxial/twisted pair wire and optical fiber avionics. Measures of effectiveness are suggested for each alternative system. An approach, which structures the technological and demand uncertainties of fiber optics, is developed through scenarios as a means of relating cost and effectiveness. It is suggested that Delphi and experience curve techniques be used in conjunction with ordered scenarios as a technological forecasting technique for estimation of life cycle costs of fiber optics. In addition, a review of the historical and technological background of fiber optics and their application to the Naval Electronics Laboratory Center (NELC) A-7 Airborne Light Optical Fiber Technology (ALOFT) Program is included. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-25018 State Univ. of New York, Buffalo.
EXPERIMENTAL INVESTIGATION OF A POTASSIUM-SEEDED ARGON PLASMA Ph.D. Thesis
Shih-Ying Wang 1975 160 p
Avail: Univ. Microfilms Order No. 76-9129

An experimental apparatus was designed and constructed for investigation of the non-equilibrium effects of a flowing argon plasma seeded with potassium and subjected to an axial electric field. Spectroscopic measurements were conducted using two optically thin potassium lines (KI 4850 A and KI 4942 A) to determine the radial distributions of electron temperature. The radial distributions of gas temperature were measured by a thin wire probe. Average electrical conductivities were obtained by measuring the electric field and total electrode current. From the measured electron temperatures, both the electron number densities and the electrical conductivities were calculated. Average values of the calculated electrical conductivity (determined from the mean-free-path and mixture rules) were also computed. Dissert Abstr.

N76-25019*# Morehouse Coll., Atlanta, Ga.
A RESEARCH PROGRAM IN MAGNETOGASDYNAMICS UTILIZING HYPERVELOCITY COAXIAL PLASMA GENERATORS Final Report
Carl Spight 31 May 1976 11 p refs
(Grant NsG-8014)
(NASA-CR-147961) Avail: NTIS HC $3.50 CSCL 20I

A broadly-gauged research program in magnetogasdynamics utilizing hypervelocity coaxial plasma generators is presented. A complete hypervelocity coaxial plasma generator facility was assembled and tested. Significant progress was made in the direction of understanding the important processes in the interaction of hypervelocity MGD flow with transverse applied fields. It is now proposed to utilize the accumulated experimental capability and theoretical analysis in application to the analysis and design parameterization of pulsed magnetogasdynamic direct energy convertor configurations. Author

N76-25020# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STRESS DISTRIBUTIONS OF COILS FOR TOROIDAL MAGNETIC FIELD
Tateo Kajita and Kenro Miyamoto Mar. 1976 31 p refs
(IPPJ-T-24) Avail: NTIS HC $4.00

The stress distributions of D shape coils and circular coils are computed by a finite element method. The dependence of the stress distribution on the geometrical parameters of the coils and supporting methods are examined. The maximum amount of the stress of D shape coils is not much smaller than that of circular coils. However the stress distribution of D shape coils becomes much more uniform. The supporting method is as influential as the geometrical parameters of the coils on the stress distribution. Author

N76-25021# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONDITION FOR ABSOLUTE CONFINEMENT OF ALPHA PARTICLES IN AXISYMMETRIC TORI
K. Ikuta Feb. 1976 9 p refs
(IPPJ-240) Avail: NTIS HC $3.50

The necessary condition for an axisymmetric torus to act as an absolute trap of fusion generated alpha particles was investigated, under the assumption that the fusion reaction occurs only on the elliptic magnetic axis where the plasma pressure is maximum. It was found that more than 50% of fusion generated alpha particles can be absolutely trapped in the axisymmetric tori if the toroidal current is larger than 11 mA. Author

N76-25022# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NUMERICAL SIMULATION OF DIFFUSE LINEAR PINCH
Y. Hirano and I. Kawakami Feb. 1976 43 p refs
(IPPJ-239) Avail: NTIS HC $4.00

A fully ionized plasma is considered. This plasma is assumed to be cylindrically-symmetric. The plasma is treated in hydromagnetic approximation, including electric and thermal conductivities and equipartition time. Separate temperatures are assigned to the electrons and ions. External circuits for 1 sub theta and I sub z currents are taken into account in order to obtain the magnetic field at the boundary. The explicit difference scheme is used for solving numerically the system of six partial differential equations. Results of the computation are in good agreement with experimetnal results. Effects of the positive bias field are investigated numerically for theta pinch. It is found that the positive bias field suppresses the density concentration and reduces beta of the plasma. Author

N76-25023# Nagoya Univ. (Japan). Inst. of Plasma Physics.
LINKED MIN.B CONFIGURATION INSIDE HIGH SHEAR MAGNETIC SURFACE
K. Ohasa and K. Ikuta Mar. 1976 21 p refs
(IPPJ-241) Avail: NTIS HC $3.50

Arrangement of the baseball coils to form the toroidally linked minimum B configuration with large rotational transform is studied analytically and numerically for 1 = m. By an optimization the closed magnetic isobars are obtained inside the last closed magnetic surface having practical volume and high shear if baseball coils are arranged for 1 = 3. Author

N76-25024# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A PROPOSAL OF JIPP TOROIDAL EXPERIMENT FOR CONFINEMENT AND HEATING OF HOT PLASMA
Kenro Miyamoto, Masami Fujiwara, and Yasuji Hamada Mar. 1976 20 p refs
(IPPJ-242) Avail: NTIS HC $3.50

The transport of high energy plasma within a hybrid toroidal field stellarator and Tokamak was studied. The optimization of the plasma heating mechanism and a reduction of heat loss were attempted in order to increase the toroidal field confinement time by increasing ion temperature. The problem of MHD instability and current distribution control is discussed. A description of the stellarator toroidal field coils, ohmic heating coils, equilibrium coils, and helical coils is presented. ASK

N76-25025# Princeton Univ., N.J. Plasma Physics Lab.
TWO NEW PROOFS OF THE TEST PARTICLE SUPERPOSITION PRINCIPLE OF PLASMA KINETIC THEORY
J. A. Krommes Dec. 1975 28 p refs
(Contract E(11-1)-3073)
(MATT-1177) Avail: NTIS HC $4.00

The test particle superposition principle of plasma kinetic theory is discussed in relation to the recent theory of two-time fluctuations in plasma given by Williams and Oberman. Both a new deductive and a new inductive proof of the principle are presented. The fundamental observation is that two-time expectations of one-body operators are determined completely in terms of the (x,v) phase space density autocorrelation, which to lowest order in the discreteness parameter obeys the linearized Vlasov equation with singular initial condition. For the deductive proof, this equation is solved formally using time-ordered operators, and the solution then rearranged into the superposition principle. The inductive proof is simpler than Rostoker's, although similar in some ways; it differs in that first order equations for pair correlation functions need not be invoked. It is pointed out that the superposition principle is also applicable to the short-time theory of neutral fluids. Author (NSA)

N76-25026# Oak Ridge National Lab., Tenn.
DEVELOPMENT OF A HELICAL MHD INSTABILITY
M. I. Gerlakh, N. M. Sueva, A. L. Morozov, and L. S. Solovev 1975 22 p refs Transl. into ENGLISH from Russian Preprint no. 74 Sponsored by ERDA
(ORNL-TR-4030; Preprint-74) Avail: NTIS HC $4.50

The development of a helical instability, in time, in a plasma torus is examined by means of a numerical solution of the equations of ideal magnetohydrodynamics with a fixed plasma boundary. It is shown that for plasma with a high conductivity this process leads to formation of a filamentous structure of the magnetic surface. Author (ERA)

N76-25027# Oak Ridge National Lab., Tenn.
INGRID: AN INTENSE NEUTRON GENERATOR FOR RADIATION-INDUCED DAMAGE STUDIES IN THE CTR MATERIALS PROGRAM
M. J. Saltmarsh, ed. and R. E. Worsham, ed. Jan. 1976 185 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5233) Avail: NTIS HC $7.75

Topics discussed include: (1) the need for a neutron irradiation facility, (2) characteristics of the neutron source, (3) the accelerator, (4) the lithium target source, (5) buildings, utilities, and experimental facilities, and (6) project management schedule, and costs. ERA

N76-25028# Los Alamos Scientific Lab., N.Mex.
SCYLLA 4-P LINEAR THETA PINCH, A DESIGN AND CONSTRUCTION OVERLOOK
A. G. Bailey and M. D. Machalek 1975 5 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego
(Contract W-7405-eng-36)
(LA-UR-75-2283; Conf-751125-88) Avail: NTIS HC $3.50

The Scylla 4-P theta-pinch device was designed as a flexible, linear experiment to investigate linear theta-pinch concepts. It is a conventional theta pinch using Scyllac components to energize a 5-m coil. Six hundred 60-kV, 1.85-mu F capacitors are used to provide 2 MJ of energy storage which will give a maximum crowbarred field of 55 kG in a smooth 11.2-cm bore coil. The risetime is approximately 3 mu s. A 4.5-kJ preionization bank ringing at 0.4 MHz is incorporated. All machine operations are under computer control, using a Prime 300 computer. The computer, the control console, and the diagnostic readouts are located in a screen room immediately adjacent to the machine. The machine was laid out in a 10-capacitor module to facilitate maintenance and make maximum use of the available volume. Author (ERA)

N76-25029# Los Alamos Scientific Lab., N.Mex.
ORIGIN OF AXIAL CURRENT IN SCYLLAC
K. Sugisaki Dec. 1975 4 p refs
(Contract W-7405-eng-36)
(LA-6178-MS) Avail: NTIS HC $4.50

The origin of the axial current observed in Scyllac (a high beta stellarator experiment) is discussed. A shaped coil and/or helical winding produce rotational transform which links magnetic lines of force to the plasma column and the axial current is induced electromagnetically. This phenomenon is inherent in a pulsed high beta stellarator. The rotational transform produced by the induced axial current is much smaller than that associated with the 1 equals 1, 0 equilibrium fields. The effect of the axial current on the equilibrium and stability of the plasma column is thus small. It is also shown that the magnetic field shear near a plasma surface is very strong. Author (ERA)

N76-25030# California Univ., Berkeley. Lawrence Berkeley Lab.
DESIGN CONSIDERATIONS AND DATA FOR GAS-INSULATED HIGH VOLTAGE STRUCTURES
D. B. Hopkins Nov. 1975 5 p refs Presented at the 6th Symp. on Eng. Probl. of Fusion Res., San Diego
(Contract W-7405-eng-48)
(LBL-4431; Conf-751125-83) Avail: NTIS HC $4.50

An approach is presented along with a summary of how various factors affect voltage breakdown. The design procedures described apply to situations where the influence of nearby insulators is negligible. The accuracy of the data is estimated to be within 10 to 15 percent, a value usually attained in practice only when one follows the cautionary advice discussed in the paragraphs on materials preparation, gas properties, and conditioning. Author (ERA)

N76-25031# California Univ., Berkeley. Lawrence Berkeley Lab.
POWER SUPPLY FOR THE LBL 40 kEV NEUTRAL BEAM SOURCE

W. R. Baker, M. L. Fitzgerald, and V. J. Honey Oct. 1975 6 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego
(Contract W-7405-eng-48)
(LBL-4418; Conf-751125-84) Avail: NTIS HC $4.50

A 20 keV, 50 Amp, 10 millisec pulse D Neutral Beam Source at the Lawrence Berkeley Laboratory that serves as the phototype for 12 similar sources now in operation on the 2XIIB Mirrow Machine at the Lawrence Livermore Laboratory was recently upgraded to operate at 40 keV. The system of electronically regulated and controlled power supplies that drive the source is described. Author (NSA)

N76-25032# California Univ., Berkeley. Lawrence Berkeley Lab.
SATURABLE REACTOR-CONTROLLED POWER SUPPLY SYSTEM FOR TCT/TFTR NEUTRAL BEAM SOURCES
W. R. Baker, D. B. Hopkins, W. L. Dexter, R. W. Kuenning, and B. J. Smith Nov. 1975 5 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego
(Contract W-7405-eng-48)
(LBL-4429; Conf-751125-85) Avail: NTIS HC $4.50

Each neutral beam source requires one major power supply, the acceleration supply, and four auxiliary power supplies. The power supplies are designed to permit independent interruption of current to any source and crowbarring within 20 mu sec, in the event of a source spark, while not disturbing the normal pulsing of all other adjacent sources. The sources are described. NSA

N76-25033# California Univ., Berkeley. Lawrence Berkeley Lab.
CONCEPTUAL DESIGN OF A NEUTRAL-BEAM INJECTION SYSTEM FOR THE TFTR
K. W. Ehlers, K. H. Berkner, W. S. Cooper, E. B. Hooper, R. V. Pyle, and J. W. Stearns Nov. 1975 5 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego
(Contract W-7405-eng-48)
(LBL-4425; Conf-751125-86) Avail: NTIS HC $4.50

The neutral-beam injection requirements for heating and fueling the next generation of fusion reactor experiments far exceed those of present devices; the neutral-beam systems needed to meet these requirements will be large and complex. A conceptual design of a TFTR Tokamak injection system to produce 120 keV deuterium-ion beams with a total power of about 80 MW is given. Author (NSA)

N76-25034# Oak Ridge National Lab., Tenn.
PROGRAM FOR DEVELOPMENT OF TOROIDAL SUPERCONDUCTING MAGNETS FOR FUSION RESEARCH, MAY 1975
H. M. Long, ed. and M. S. Lubell, ed. Nov. 1975 142 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5109) Avail: NTIS HC $7.60

The objective of this program is a tested magnet design which demonstrates the suitability and reliability,needed to qualify toroidal superconducting magnets for fusion research devices in a time compatible with the D-T burning experiments time frame. The overall applied development program including tasks, manpower, and cost estimates are detailed, but for the full toroidal system only the cost and time frame are outlined to show compatibility with the present program. Author (ERA)

N76-25035# Science Research Council, Chilton (England).
STRESS ANALYSIS STUDIES IN OPTIMIZED 'D' SHAPED TOKAMAK MAGNET DESIGNS
N. J. Diserens Jul. 1975 16 p
(RL-75-117) Avail: ERDA Depository Libraries HC $4.50

A suite of computer programs TOK was developed which enabled simple data input to be used for computation of magnetic fields and forces in a toroidal system of coils with either D-shaped or circular cross section. An additional requirement was that input data to the Swansea stress analysis program FINESSE could be output from the TOK fields and forces program, and that graphical output from either program should be available. A further program was required to optimize the coil shape. This used the field calculating routines from the TOK program. The starting point for these studies was the proposed 40 coil Princeton design. The stresses resulting from three different shapes of D-coil were compared. Author (ERA)

N76-25036# Princeton Univ., N.J. Plasma Physics Lab.
MECHANICAL DESIGN OF A 250 KILO-GAUSS SOLENOIDAL MAGNET
P. Bonanos Dec. 1975 11 p Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 18-21 Nov. 1975
(Contract E(11-1)-3073)
(MATT-1133; Conf-751125-108) Avail: NTIS HC $4.00

The mechanical design and construction of a 5 cm bore, 23 cm long solenoidal magnet operated at 250 kilogauss is described. The magnet provides confining field for a plasma heated by a CO2 Laser. Radial diagnostic ports with a clear aperture of 0.41 cm allow viewing access near the magnet midplane. The on-axis field homogeneity is within 5 percent over a central length of 12 cm. The magnet sustained 500 to 1,000 pulses at the highest field levels before catastrophic failure. Author (NSA)

N76-25037# Princeton Univ., N.J. Plasma Physics Lab.
COUNTERSTREAMING-ION TOKAMAK NEUTRON SOURCE FOR LARGE AREA SURFACE RADIATION STUDIES
D. L. Jassby Nov. 1975 35 p refs Presented at the Intern. Conf. on Radiation Test Facilities for the CTR Surface and Mater. Program, Argonne, Ill.
(Contract E(11-1)-3073)
(MATT-1165; Conf-750723-19) Avail: NTIS HC $4.00

A tokamak neutron source that produces a neutron flux approximately 10 to the 13th power n/sq cm/s over a wall test-area of 30 sq m is designed using near state-of-the-art Tokamak and neutral-beam injection technologies. To maximize fusion reactivity, D and T plasma ions are grouped in two distinct quasi-thermal velocity distributions, oppositely displaced in velocity along the magnetic axis. Such counterstreaming distributions can be set up by tangential injection of all plasma ions by oppositely directed D and T neutral beams, by facilitating removal of completely decelerated ions, and by minimizing plasma recycling. Fusion energy is produced principally by head-on collisions between D and T ions in the counterstreaming distributions. For injection energies of 40-60 keV, and typical Tokamak parameters, the fusion power density can be approximately 1 W/cu cm, with Q approximately 1 attainable for T/sub e/equals 3.4 keV and electron energy confinement parameter n/sub e/tau/sub E/ approximately equal to 2 x 10 to the 12th power cm s. All plasma fueling is carried out by the injected beams, and when a significant fraction of the electron population is trapped, the plasma current can be maintained by the beams. Author (NSA)

N76-25038# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY FLUX LIMITATION BY TAME TURBULENCE
Wallace M. Manheimer Nov. 1975 19 p refs Presented at the APS Meeting, St. Petersburg, Fla., 10-14 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77149; Conf-751130-7) Avail: NTIS HC $4.50

A quasi-linear theory of energy flux limitation by ion acoustic turbulence in plasmas, is presented. This distribution function was modelled by a Maxwellian plus an additional piece which carries a heat flux Q. By taking the fourth moment of the Vlasov equation, the anomalous thermal conductivity K was determined. Other moments treated self-consistently include ion heating, electron cooling, current generation and enhanced inverse bremsstrahlung due to the nonthermal ion fluctuations. Author (ERA)

N76-25039# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER ANALYSIS OF FOUR CHANNEL X-RAY MICROSCOPY IMAGES TO OBTAIN SOURCE AND SPECTRAL EMISSION DATA ON LASER FUSION
Thomas L. Harper 6 Oct. 1975 29 p Presented at the APS Meeting, St. Petersburg, Fla., 10-14 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77075; Conf-751130-13) Avail: NTIS HC $5.00

It is possible to analyze the images obtained from the four channel X-ray microscope to obtain reasonable estimates of source

spatial and energy emission. The technique is particularly useful when relative comparisons are desired in which, from shot to shot, few parameters are changed. These data are of use in fuel pellet design and in checking design code predictions. The technique should also apply to pinhole camera data. Largest uncertainties appear to be due to film energy/handling calibration and mirror efficiency measurements. Author (NSA)

N76-25040# California Univ., Livermore. Lawrence Livermore Lab.
RADIATIONALLY-INDUCED RADIAL CONTRACTION OF Z-PINCHES
J. W. Shearer Nov. 1975 32 p refs
(Contract W-7405-eng-48)
(UCID-16973) Avail: NTIS HC $5.00

A one-dimensional calculation of the radial motion of a Z-pinch was based on the Bennett relation, ohmic heating, and radiation loss. The result shows that the pinch will shrink if its current exceeds the Pease-Braginskii current (.1-1.5 megamps, depending on the radial density distribution and the impurity level), and if the shrinkage rate exceeds the growth rate of instabilities. It is suggested that the approximately 0.1 mm X-ray sources observed in plasma focus experiments are produced by this mechanism. Author (ERA)

N76-25041# Oak Ridge National Lab., Tenn.
NEW METHOD FOR LOCAL MEASUREMENT OF THE EFFECTIVE CHARGE AND THE ION DENSITY IN A TOKAMAK
R. Dei-Cas Aug. 1975 15 p refs Transl. into ENGLISH from French Report EUR-CEA-FC-775
(ORNL-tr-4047; EUR-CEA-FC-775) Avail: NTIS HC $4.50

A new method is proposed to measure the local effective charge and the local ion density in a Tokamak plasma. The method is based on the measurement of the local captured fraction of a fast neutral injected beam. Author (NSA)

N76-25042# Joint Inst. for Nuclear Research, Dubna (USSR).
MATHEMATICAL MODELING OF THE DYNAMIC THREE-DIMENSIONAL NONLINEAR PROBLEM OF THE PHYSICS OF WEAKLY TURBULENT PLASMA, 1
B. S. Getmanov and V. G. Makhankov 1975 20 p refs In RUSSIAN
(JINR-P11-9112) Avail: ERDA Depository Libraries HC $4.50

The dynamics of weak anisotropic Langmuir turbulence, excited by a relativistic electron beam and determined by processes of induced scattering on ions, were modeled by numerical methods. It was found that in the process of evolution the distribution of the wave with respect to the scattering angle becomes symmetrical with respect to pi/2 but remains sharply anisotropic. The latter effect was illustrated by graphs of the behavior with time of the function of anisotropy. The possibility of nonlinear stabilization of the instability was illustrated. Author (NSA)

N76-25043# Los Alamos Scientific Lab., N.Mex.
DIRECT EVALUATION OF TRANSIENT SURFACE TEMPERATURES AND HEAT FLUXES
Roy A. Axford Aug. 1975 8 p ref
(Contract W-7405-eng-36)
(LA-6051) Avail: NTIS HC $4.50

Evaluations of transient surface temperatures resulting from the absorption of radiation are required in laser fusion reactor systems studies. A general method for the direct evaluation of transient surface temperatures and heat fluxes on the boundaries of bounded media is developed by constructing fundamental solutions of the scalar Helmholtz equation and performing certain elementary integrations. Author (NSA)

N76-25044# California Univ., Livermore. Lawrence Livermore Lab
NONTHERMAL EFFECTS IN TWO COMPONENT DT FUSION REACTORS
Thomas A. Weaver and T. C. Chu (Ill. Univ.) 7 Nov. 1975 12 p refs Presented at the ASP Meeting, St. Petersburg, Fla., 10-14 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77168; Conf-751130-16) Avail: NTIS HC $3.50

Net energy generation rates and f-factors are calculated for a variety of two component DT reactor configurations using a computer code that follows the energy distributions of the reactants and products explicitly, utilizing the Fokker-Planck approximation for low-angle Coulomb scattering and a transfer matrix for high angle Coulomb, nuclear and radiative processes. The relative importance of such nonthermal effects as alpha particle deposition non-Maxwellian energy distributions for the target tritons and electrons, and the influence of high-angle Coulomb and nuclear scattering on the energy loss rate of the injected deuterons is explicitly assessed. Author (NSA)

N76-25045# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
FEEDBACK STABILIZATION OF A SCREW PINCH
R. Keller, A. Pochelon, and W. Bachmann Oct. 1975 6 p refs
(LRP-96/75) Avail: NTIS HC $3.50

The correct behavior of a thermonuclear reactor will require an evolved automatic control system, which allows for the adjustment of a great number of parameters. One of the most important feedback loops will have the task of maintaining plasma equilibrium and suppressing dangerous MHD instabilities. The aim is to demonstrate the feasibility of stabilizing the fast kink mode of a screw pinch working above the Kruskal-Shafranov limit. Author (ESA)

N76-25046# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
ASYMPTOTIC FORM OF GREEN'S FUNCTION FOR WAVE EMISSION IN PLASMAS
E. S. Weibel Nov. 1975 17 p refs
(LRP-98/75) Avail: NTIS HC $3.50

Green's function for the emission of radiation from an oscillating point source within a plasma is examined in the limit of large distances from the source. The plasma is characterized by its susceptibility tensor leading to the dispersion relation D = 0. Asymptotic formulae are derived which state that only those points in k-space contribute to the far field which satisfy the dispersion relation and for which the group velocity points towards the observer. The intensity of the emission is inversely proportional to the Gaussian curvature of the surface D = 0 at that point. The result is generalized for the case in which this curvature vanishes. Author (ESA)

N76-25047# Laboratoire d'Aerothermique du C.N.R.S., Meudon (France).
EFFECT OF THE THERMAL NONEQUILIBRIUM ON THE CHEMICAL RELAXATION TIME IN A MULTIREACTIVE PLASMA [INFLUENCE DU DESEQUILIBRE THERMIQUE SUR LES TEMPS DE RELAXATION CHIMIQUE DANS UN PLASMA MULTIREACTIF]
B. Rowe and R. Prudhomme Apr. 1975 48 p refs In FRENCH
(Rept-75-1; Publ-496) Avail: NTIS HC $4.00

The thermal nonequilibrium of a nitrogen plasma due to differences between translational temperature, vibrational temperature, and electron temperature, and its effect on the equilibrium concentrations as well as on relaxation time is investigated. The concept of partial chemical equilibrium is introduced, and the chemical concentrations at equilibrium, and chemical relaxation time near such an equilibrium, are studied for the five chemical species existing in laboratory nitrogen plasma. The effects of a difference between translational and vibrational temperature, and between translational and free electron temperature are observed, and differences between the three temperatures are taken into account. Quantitative results are presented for concentrations and relaxation times at various temperatures. ESA

N76-25048# European Space Agency, Paris (France).
HOLLOW CATHODE DISCHARGE: ARC REGIME WITH INTERIOR POSITIVE COLUMN IN A FLOW OF ARGON
Andre Brunet Apr. 1976 64 p refs Transl. into ENGLISH of 'Decharge a Cathode Creuse: Regime d'Arc avec Colonne Positive Interieure et Ecoulement d'Argon', ONERA, Paris Report ONERA-NT-1975-3, 1975

(ESA-TT-282; ONERA-NT-1975-3) Avail: NTIS HC $4.50

The plasma generated in the hollow cathode was investigated. The device used comprises a cathode and an anode with a central orifice through which the plasma is ejected. The anode is placed at the cathode outlet. The study of argon flow inside the cathode emphasized the presence of a sonic flow in the cathode outlet section. Assuming the gas temperature equal to that of the wall, the pressure distribution inside the cathode was determined. The plasma characteristics were measured with electrostatic probes; electron densities reached 10 sup 14 electrons/cu cm, electron temperatures were 1 to 2 eV, and plasma potentials were close to the anode potential, the major part of the discharge voltage being concentrated within the cathode sheath. The influence of the cathode material on the discharge characteristics is emphasized. The use of materials whose electron emission is greater than that of refractory metals of current use, permits lowering of the cathode temperature as well as of the discharge voltage. With LaB6 cathodes it was possible to operate the discharge with a total voltage lower than the argon ionization potential, which is explained by a two-step ionization process with a metastable level in-between.

Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N76-25049* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PROCESS FOR FABRICATING SiC SEMICONDUCTOR DEVICES Patent

J. Anthony Powell and Herbert A. Will, inventors (to NASA) Issued 11 May 1976 20 p Filed 24 Sep. 1974 Supersedes N74-33740 (12 - 23, p 2806)

(NASA-Case-LEW-12094-1; US-Patent-3,956,032; US-Patent-Appl-SN-508784; US-Patent-Class-148-175; US-Patent-Class-156-610; US-Patent-Class-156-612; US-Patent-Class-156-613; US-Patent-Class-252-62.3; US-Patent-Class-423-345; US-Patent-Class-423-346) Avail: US Patent Office

Sections are cut from a SiC platelet such that the sections have a-faces parallel to the c-axis of the SiC platelet. The sections serve as substrates for the growth of SiC layers by attaching the substrates to a body which is then placed in a chamber and the chamber evacuated. Hydrogen is then admitted, and the body on which the substrates are mounted is heated to produce a temperature profile such that the subsequent admission of a carbon containing chlorosilane gas or a mixture of a chlorosilane gas and a hydrocarbon gas will cause free silicon to be deposited at one end of the body while SiC crystals grow on the substrates which are in a preferred temperature range. Dopant gases, either p-type or n-type, can be admitted with the chlorosilane or hydrocarbon gas to produce the desired type of semiconductor. Official Gazette of the U.S. Patent Office

N76-25050 British Library Lending Div., Boston Spa (England).

FERROELECTRIC MATERIALS FOR COMPONENTS OF THE FUTURE

J. Pottharst Jul. 1975 21 p refs Transl. into ENGLISH from Elektronik (West Ger.), vol. 23, no. 11, 1974 p 409-414 (BLL-DRIC-Trans-4110-(3623.66); BR45189) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The application options of ferroelectric materials are discussed in terms of their dielectric, piezoelectric, and optical properties. The methods for preparing ferroelectric ceramics and their uses are presented. F.O.S.

N76-25051 British Library Lending Div., Boston Spa (England).

EXISTENCE OF A CRITICAL ELECTRIC FIELD IN THE PYROELECTRIC BEHAVIOR OF TRIGLYCINE SULPHATE (TGS)

B. Jannot Aug. 1975 18 p refs Transl. into ENGLISH from Rev. de Phys. Appl. (France), no. 9, 6 Nov. 1974 p 955-960 (BLL-DRIC-Trans-4142-(3623.66)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The effects of an electric field on the pyroelectric behavior of triglycine sulfate (TGS) has been studied at thermal equilibrium. Pyroelectric signal measurements show that the coefficients $p = dP/dT$, is an increasing function in a weak electric field, and that it only becomes a decreasing function in a strong field. Author

N76-25052 British Library Lending Div., Boston Spa (England).

DYNAMIC MODEL OF THE PROCESS OF GROWING SINGLE CRYSTALS BY THE CZOCHRALSKI METHOD

I. M. Gold and U. S. Leibovich [1974] 9 p refs Transl. into ENGLISH from Tsvetn. Metal. (Moscow), Oct. 1974 p 47-50 (BLL-RRE-Trans-475-(8036.625)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A method of controlling the growth process of single crystals is considered. A dynamic model of growth process in the region of small deviation in the parameters is examined. The optimum growth is characterized by a plane front of crystallization and a constant diameter. Considering the deviation from optimum conditions a planar crystallization front is assumed. Author

N76-25053 Wayne State Univ., Detroit, Mich.

ELECTRICAL PROPERTIES OF SUPERCONDUCTING PB FILMS AND PB/AG LAYERED FILMS Ph.D. Thesis

Linda M. Geppert 1975 107 p

Avail: Univ. Microfilms Order No. 76-10947

Intermediate quantum-resistance (IQR) states have been interpreted in terms of the momentum quantization of bound quasiparticles in the magnetic-field-induced central normal layer of the film. Based upon this model, phenomenological equations have been developed which express the experimental quantities associated with the IQR states in terms of the thickness of the normal layer and the energy gap of the superconducting surface sheaths. IQR states observed in Pb films and Pb/Ag layered films are compared with the phenomenological model. It is found that the model correctly predicts the magnetic field dependences of the experimental quantities associated with the IQR states, and in some cases agreement is even quantitative.

Dissert. Abstr.

N76-25054 Wayne State Univ., Detroit, Mich.

MICROWAVE SURFACE IMPEDANCE OF SUPERCONDUCTORS IN MAGNETIC FIELDS Ph.D. Thesis

Suk Hong Kim 1975 104 p

Avail Univ. Microfilms Order No. 76-10968

For a magnetic field parallel to the surface of a superconductor the microwave surface resistance at X-band frequencies is strongly anisotropic with respect to the orientation of the microwave current relative to the magnetic field. This anisotropy has been investigated for type-I lead films and type-II lead-indium alloy at various magnetic fields and temperatures. The observed anisotrophy of the surface resistance for the magnetic field parallel to the sample surface is consistently described in terms of the oscillatory flux-flow for type-II and the surface sheath-normal layer oscillations for type I superconductors. The dc flux-flow resistivity for the zero Kelvin limit in the field perpendicular to the surface is generalized to a microwave region in the parallel field for a wider range of temperatures. Dissert. Abstr.

N76-25055 South Carolina Univ., Columbia.

INVESTIGATION OF BONDING MECHANISM IN PYRITE USING MOSSBAUER EFFECT AND X-RAY CRYSTALLOGRAPHY Ph.D. Thesis

Samuel Leon Finklea, III 1975 109 p

Avail: Univ. Microfilms Order No. 76-10454

The nature of the bonding in pyrite is considered in relation to the origin of the quadrupole splitting observed by means of the Mossbauer effect and the angular variation of the recoil free fraction. It is found that neither crystal field effects nor stoichiometry are enough to account for the observed splitting. Consideration of molecular orbital effects, however, show that a very small amount of electron delocalization is enough to cause the observed splitting because of the strong effects the valence electrons have on the iron nucleus. It is also found that, contrary to previously published data, the recoil free fraction is practically independent of angle. This result is derived both from Moss-

bauer resonance measurements and from an x-ray structural determination. Dissert. Abstr.

N76-25056 Johns Hopkins Univ., Baltimore, Md.
AN EXCHANGE MODEL OF ANTIFERROMAGNETISM Ph.D. Thesis
Harry Krewson Charles, Jr. 1972 226 p
Avail: Univ. Microfilms Order No. 76-11204

A nearest-neighbor two sublattice model of antiferromagnetism has been constructed for arbitrary spin using the Schrodinger exchange operator. By use of diagrammatic and cluster expansion technique, eight terms in the high temperature series for the low-field staggered susceptibility are obtained for the open lattices. Critical parameters such as the Neel temperature, T sub n and critical point exponent, gamma sub n, are estimated from the finite (eight term) series by various transformation, ratio techniques, and Pade approximations. Analysis yielded the first reliable estimates of the critical point exponent, gamma sub n, for a quantum mechanical model of antiferromagnetism. On the cubic lattices (gamma)(n) = 1.40 + .03, .02 (gamma)(n) = 1.30 + or - .05 for S = 1/2 and S = 1, respectively. The value for S = 1/2 compares quite closely with results for the ferromagnetic exchange model as well as with recent classical and experimental determinations. Dissert. Abstr.

N76-25057 Colorado Univ., Boulder.
SPIN-FLIP SCATTERING FROM HOLE STATES IN A SEMICONDUCTOR Ph.D. Thesis
Ralph LeRoy Hollis, Jr. 1975 267 p
Avail: Univ. Microfilms Order No. 76-11583

Spin-flip scattering experiments performed on a p-type material are reported. The results show that spin-flip scattering of laser light from valence band hole states was achieved. Measured heavy hole gyromagnetic ratios (g values) for the p-type semiconductor compound ZnTe varied from g-0.9 to g-1.1. Both Stokes and anti-Stokes spectra are observed, as well as the spin-flip polarizations. These measurements are extended to fields up to 148 kG by a technique of pumping on the liquid helium bath. Dissert. Abstr.

N76-25058 California Univ., San Diego.
SPIN PROPERTIES OF A CRYSTAL \ELECTRON IN A MAGNETIC FIELD Ph.D. Thesis
William John Lamb 1975 140 p
Avail: Univ. Microfilms Order No. 76-10117

The Schrodinger equation is solved for the effective Hamiltonian of a crystal electron in a magnetic field, including the effects of the spin orbit interaction, in a one electron approximation, and to first order in the magnetic field, by using a method closely related to the WKB procedure. It is shown that the spin splittings of the eigenvalues, can be obtained from the average precession frequency of a pseudospin, which obeys a classical spin equation. This classical equation involves a G censor dependent upon a wave vector, which is obtained from the effective Hamiltonian. The G tensor is not unique, but it is shown that this does not affect the calculated value of the spin splittings. Explicit formulas for the spin splittings are worked out for several special cases, including that of weak spin-orbit interaction. Several possible definitions of a local g-factor are discussed.
Dissert. Abstr.

N76-25059*# Boeing Co., Seattle, Wash.
SPACE PROCESSING FLOAT ZONE THERMAL ANALYSIS
J. T. Pogson and D. M. Anderson May 1976 62 p
(Contract NAS8-31635)
(NASA-CR-144294) Avail: NTIS HC $4.50 CSCL 20B

Thermal analysis (BETA) computer program adaptations were prepared to analyze phase change histories in crystal specimens. The first program (BETA-CYL) treats right circular cylinder configurations and the second, more general, program (BETA-BOR) treats a generalized body-of-revolution configuration. A series of computer runs were made for silicon material to determine boundary conditions which produce flat solidification interfaces while, at the same time, minimizing peak temperatures in the molten zone. Flat solidification interfaces are a goal believed by some investigators to be required to produce high quality semiconductor materials. The thermal effects of convection in a molten zone were examined and found to be negligible in comparison to the conduction heat transfer of the melt. Author

N76-25060# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Chemistry.
ELECTRON PARAMAGNETIC RESONANCE OF IONS SUBSTITUTED IN PARAMAGNETIC TRANSITION METAL ION HOSTS
Michael Robert StJohn Nov. 1975 175 p refs
(Contract W-7405-eng-48)
(LBL-4185) Avail: NTIS HC $6.75

Criteria for reasonably sharp spectra are presented, and the literature of observed impurity spectra in various hosts is reviewed. It is shown that unexplained line width effects can be explained in terms of host spin--lattice relaxation narrowing and spin quenching. Host spin--lattice relaxation narrowing produces sharp impurity lines when the host has a fast T1 and the impurity has a T1 slow enough not to broaden the lines. Below 2 K, the spectra of Cu(2+), Co(2+), Mn(2+), and V(2+) substituted into the partially quenched alpha NiSO4 . 6H2O and NiSeO4 . 6H2O lattices were observed. For Cu(2+) positive shifts of 0.2 to 0.8 unit occur in the g-value when alpha-NiSO4 . 6H2O is compared to the isostructural ZnSeO4 . 6H2O lattice. All exchange interactions are for hydrated ions and take place through hydrogen bonds. The impurity spectra in alpha NiSO4 . 6H2O and NiSeO4 . 6H2O are observed to broaden very rapidly as the temperature is raised, becoming unobservable at 4.2 K. ERA

N76-25061# California Univ., Berkeley. Lawrence Berkeley Lab.
KINETICS AND MECHANISMS OF SINGLE PHASE SOLID STATE SINTERING Ph.D. Thesis
B. Wong Aug. 1975 171 p refs
(Contract W-7405-eng-48)
(LBL-3957) Avail: NTIS HC $7.75

In general, kinetic and microstructural data satisfactorily support the proposed theoretical concepts. Sintering kinetic models based on rate controlling mass transport mechanisms, unified macroscopic viscous flow, and microscopic vacancy diffusion concepts were used to develop equations for both the intermediate and final stages of sintering. Experimental sintering studies on both undoped and CaO doped MgO powder compacts in static air and flowing water vapor atmospheres were performed in a temperature range between 1280 and 1600 C. Corresponding microstructural changes of sintered specimens during sintering were examined with a scanning electron microscope. Sintering kinetic data obtained were subsequently analyzed in terms of the appropriate proposed models; mechanisms of the sintering process under different experimental conditions were thus determined. Author (ERA)

N76-25062# Argonne National Lab., Ill.
PURE TENSION SUPERCONDUCTING TOROIDAL-FIELD COIL SYSTEM DESIGN STUDIES FOR THE ARGONNE EXPERIMENTAL POWER REACTOR
S. T. Wang, J. R. Purcell, D. W. Demichele, and L. R. Turner Nov. 1975 6 p refs Presented at the 6th Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 18-21 Nov. 1975
(Contract W-31-109-eng-38)
(ANL/HEP-CP-75-70; Conf-751125-77) Avail: NTIS HC $4.50

As part of the Argonne Tokamak Experimental Power Reactor (TEPR) design studies, a toroidal field (TF) coil system has been designed. NbTi was chosen as the most suitable superconductor and 8T was regarded as a practical peak field level. The 16-coil design was chosen as a reasonable compromise between 2 percent field ripple and 3 m access gap. To minimize the coil structure and the bending moments on the conductor, a pure tension coil shape is necessary. A correct approach for determining the pure tension coil profile in a bumpy TF coil system is given. Verification of the pure tension coil by a three-dimensional stress analysis is presented. For coil quench protection, a series- connected scheme is proposed. Author (NSA)

N76-25063# Stanford Univ., Calif. Solid-State Electronics Lab.
THE USE OF ION IMPLANTATION FOR THE CONTROL OF IMPURITY DIFFUSION IN 3-5 COMPOUND SEMICON-

DUCTORS Final Report, 1 May 1972 - 30 Apr. 1975
James F. Gibbons Sep. 1975 16 p refs
(Contract DAHC04-72-C-0031)
(AD-A018760; SU-SEL-75-040; ARO-10290.2-EL) Avail: NTIS CSCL 20/12

The report summarizes research carried out under one Contract. The principal results obtained were: (1) Proton-enhanced diffusion was used for the first time to obtain Se diffusion in GaAs. Seventy percent electrical activity was obtained for a dose of 10 to the 14th power Se/sq cm, which is the highest electrical activity yet reported for this dose level. (2) A theory was developed to explain the relatively low doping efficiency of n-type dopants in GaAs, a phenomenon that is always present though especially apparent in ion-implanted samples. (3) Wide range control over the diffusion coefficient of Zn in GaAs(0.6)P(0.4) was obtained through the use of multiple implants of Zn, Ga, As, and/or P. A theory was developed to explain the magnitude of the control in terms of thermodynamic restrictions on the range of gallium vacancy concentrations that can exist at equilibrium in the material. (4) Proton-enhanced diffusion (PED) was used to introduce Cd into InSb. A new Cd diffusion source and a new technique for the anodic stripping of InSb were developed in the course of the work. GRA

N76-25064# Oak Ridge National Lab., Tenn.
INVERSE MEAN FREE PATH, STOPPING POWER, CSDA RANGE, AND STRAGGLING IN ALUMINUM AND ALUMINUM OXIDE FOR ELECTRONS OF ENERGY >10 keV Interim Report
J. C. Ashley, C. J. Tung, W. E. Anderson, and R. H. Ritchie Dec. 1975 55 p refs Sponsored in part by AF, ERDA, and Union Carbide Corp., N. Y.
(DNA Proj. NWED-QAXTA040)
(AD-A019507; AFCRL-TR-75-0583; SR-1) Avail: NTIS CSCL 20/12

The interaction of electrons with the solids Al and Al2O3 is described based on the electron gas model for the conduction band electrons in Al, a model insulator theory for the valence electrons in Al2O3, and inner shell ionization derived from atomic, generalized oscillator strengths. Contributions to the inverse mean free path and stopping power from the various interaction processes are tabulated for electron energies from 0.5 eV to 10 keV for Al and from 10 eV to 10 keV for Al2O3. Electron range in the continuous-slowing-down approximation and straggling are tabulated for electron energies from 10 eV to 10 keV for both materials. GRA

N76-25065# Illinois Univ., Urbana. Coordinated Science Lab.
OPTIMAL SUMMATION OF GAUSSIANS FOR ION IMPLANTATION PROFILE CONTROL
Andrew Joseph Zaremba Nov. 1975 75 p refs
(Contract DAAB07-72-C-0259; Grant NSF GH-40450)
(AD-A019422; UILU-ENG-75-2238; R-698) Avail: NTIS CSCL 20/12

The fact that the number of implanted ions can be accurately determined and controlled is used in the processing of numerous semiconductor devices. By contrast, there is very little fabrication of solid state devices which effectively uses the spatial impurity distribution of implanted ions. To a large degree, this is because the distribution of a particular implant is Gaussian, which is not a particularly useful profile. However, by using multiple implants the individual Gaussians may be effectively summed to approximate a wide range of desired impurity distributions. The summation of Gaussian distributions to achieve arbitrary functions is a mathematical problem of general interest, and the usefulness of solving the problem extends far beyond the desire to approximate impurity distributions in semiconductors. Unfortunately, the solution here is complicated by the physics of the situation which limits the available Gaussian expansion functions. Under this condition it will be shown that the analytical solution of the problem is not feasible. A numerical solution is presented for a number of profiles, indicating that many desirable impurity distributions may be satisfactorily approximated. GRA

N76-25066# Illinois Univ., Urbana. Dept. of Electrical Engineering.
SURFACE AND BULK ELECTRONIC PHENOMENA IN SOLIDS Final Report, 15 Sep. 1971 - 14 Sep. 1975
C. T. Sah Nov. 1975 28 p refs
(Grant AF-AFOSR-2067-71; AF Proj. 9761)
(AD-A019516; AFOSR-75-1651TR) Avail: NTIS CSCL 20/12

Experimental and theoretical studies have been undertaken on the atomic origins, the electronic properties and the generation, annealing and migration kinetics of the oxide charges and interface surface states in the silicon oxide-silicon MOS system. The two principle electronic properties of these oxide charges and interface surface states as well as the imperfection centers located in surface space charge layer of silicon are studied. These are: (1) The density of state and the carrier recombination, generation and trapping properties at the interface states and at the centers located in the surface space charge layer and (2) The mobilities of electrons and holes in the silicon surface layer due to the scattering by the spatially randomly distributed oxide charges and charged as well as neutral interface states and by the lattice vibrations or phonons. These properties are related to the electrical characteristics of MOS devices, including MOS capacitors, MOS transistors and special structures which simulate electron-beam accessed MOS mass memory devices. A novel distributed bistable MOS transistor with voltage controlled negative resistance characteristics is also studied. GRA

N76-25067# Illinois Univ., Urbana. Dept. of Chemistry.
NMR INVESTIGATIONS OF SOLID (CH3) 3CCOOH (TRIMETHYLACETIC ACID) AND (CH3)3CCOOD
S. Albert, H. S. Gutowsky, and J. A. Ripmeester 2 Jan. 1976 21 p refs
(Contract N00014-75-C-0163; NR Proj. 056-547)
(AD-A019508; TR-8) Avail: NTIS CSCL 07/4

(CH3)3CCOOH (trimethylacetic or pivalic acid) and (CH3) 3CCOOD have been investigated in the plastic and brittle modifications by pulsed and continuous wave proton magnetic resonance methods between 77K and the melting point (310K). For the low temperature phase of (CH3)3CCOOD, the second moment and spin-lattice relaxation time (T1) of the protons are in agreement with a combination of methyl group (C3) and t-butyl group (C3): reorientations having activation energies Ea of 2.35 plus or minus 0.15 and 4.00 plus or minus 0.25 kcal/mole, respectively. In the high temperature plastic phase above the transition at 280K, overall molecular tumbling with an Ea of 6.0 plus or minus 0.6 kcal/mole governs T1, and self-diffusion with an Ea of 12 plus or minus 2 kcal/mole is evident from the spin-lattice relaxation time in the rotating frame (T1p). Also, it is found that T1p falls significantly below T1 in the 30K just below the transition. The deviation increases to as much as an order of magnitude as the transition temperature is approached, being about three-fold larger for the protonated form of the acid than for the deuterated. This behavior is consistent with the slow onset of molecular tumbling. We suggest that the faster rate in the protonated compound may be attributed to the importance of quantum mechanical tunneling in the breaking and reforming of hydrogen bonds during the tumbling process. GRA

N76-25068# Denver Research Inst., Colo. Metallurgy and Materials Science Div.
SOLID-STATE HYDROGEN STORAGE MATERIALS OF APPLICATION TO ENERGY NEEDS Semiannual Technical Report, 1 Jan. - 30 Jun. 1975
Charles E. Lundin and Frank E. Lynch Jul. 1975 31 p refs
(Contract F44620-74-C-0020; ARPA Order 2552-1)
(AD-A019528; AFOSR-75-1482TR; SATR-2) Avail: NTIS CSCL 07/4

During this period, four general areas of effort were pursued: (1) Design and construction were completed on a high pressure hydriding apparatus, which will reach about 2,000 bars in comparison with the 136 bars available in the present Sievert apparatus. Construction has had to include the pressure-measuring device for the upper two-thirds of the scale, not available commercially in non-hydrogen-embrittleable metal. (2) The major effort on rates of desorption of hydrogen from LaNi5 was completed, after a number of reactor designs were employed in order to find the optimum conditions and purities. The first-cycle rate of desorption yields a second-order rate constant of 0.077 per second per unit ratio of H atoms to LaNi5. Over the temperature range 15 to 25 C., the activation energy is 21.9 kcal/mole. (3) Poisoning of LaNi5 by air, oxygen and water

was studied up to 100 C with the conclusion that effects on hydriding are only temporary and limited to rate effects. (4) Preliminary hydrogen absorption-desorption measurements were made with 10 alloys and intermetallic compounds. These were selected compositions in the V-Cr and Nb-Mo systems, aluminum-saturated alpha-titanium, and the compounds CoTi, CeAl, CeAl2, CeAl4, and CeFe5. A few of the results encourage further study. GRA

N76-25069# Epsco Labs., Stamford, Conn.
GALLIUM ARSENIDE PHOTOCATHODE DEVELOPMENT Final Technical Report, 6 Jun. 1973 - 31 Dec. 1974
Terry Roach and J. Bianca Oct. 1975 62 p refs
(Contract F08606-73-C-0028; ARPA Order 1965; AF Proj. 1965)
(AD-A018619; RADC-TR-75-254) Avail: NTIS CSCL 20/12

This report presents the final results of a task to investigate III-V photoemitter technology for application to image sensors. Investigations of crystal surface preparation, the physics of GaAs photoemission, photocathode processing techniques, GaAs photocathode characteristics and reprocessing techniques have been completed. Emphasis was placed on the development of a transmissive GaAs photocathode with sensitivity, uniformity, size and life suitable for high resolution low light level imaging applications. GRA

N76-25070# Arkansas Univ., Fayetteville. Dept. of Electrical Engineering.
INFRARED RESPONSE OF IMPURITY DOPED SILICON MOSFET'S: EXPERIMENTAL CHARACTERIZATION OF THE INFRARED RESPONSE OF GOLD DOPED SILICON MOSFET'S IRFET'S Semiannual Technical Report
Leonard Forbes 1 Feb. 1975 37 p refs
(Contract F19628-75-C-0071; ARPA Order 2794; AF Proj. 2794)
(AD-A018784; AFCRL-TR-75-0168; SATR-1) Avail: NTIS CSCL 17/5

The use of an impurity doped silicon MOSFET as an infrared detector (IRFET) has recently been proposed. This report gives a description of the operation of this new type of infrared detector and provides experimental verification of the design. The IRFET is an integrating static read only memory element whose conductance is modulated by infrared radiation. Operation has been observed and characterized using the gold acceptor level and gold donor level in the near infrared wavelength range from 1.0 to 3.0 microns. It will be shown from pulsed capacitance measurements on MOS capacitors and from measurement of the IRFET response that the characteristics of the gold impurity center in the surface space charge region correspond to the results observed previously for the center in bulk silicon. Operation of the IRFET can then be described on the basis of a simple model where the change in charge state of the impurity center in the surface space charge region due to photoionization modulates the threshold voltage of the MOSFET and thus conductance of the device. GRA

N76-25071# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
CRYSTALLINE STRUCTURE OF PYROCARBON FILM DEPOSITED ON PYROLYTIC BORON NITRIDE Interim Technical Report
Francis M. Wachi, Arthur G. Whittaker, and Ethel J. Watts 4 Dec. 1975 18 p refs
(Contract F04701-75-C-0076)
(AD-A019437; TR-0076(6250-11)-1; SAMSO-TR-75-286) Avail: NTIS CSCL 11/2

Transmission electron diffraction data have indicated that the pyrocarbon films deposited on pyrolytic boron nitride consist of a mixture of crystalline and amorphous carbon phases. The crystalline structures appear to be of two allotropic modifications of carbon: graphite and carbyne. These carbyne crystals were produced during the deposition of pyrocarbon on pyrolytic boron nitride rods at a moderate temperature and pressure by the decomposition of methane. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-25072 Wisconsin Univ., Madison.
EXCHANGE EFFECTS IN QUANTUM STATISTICAL MECHANICS Ph.D. thesis
Myron Lawrence Cramer 1975 106 p
Avail: Univ. Microfilms Order No. 76-2473

A combinatorial treatment of exchange effects for many-particle systems is made by writing the N-particle cluster integral for a system of hard-sphere bosons in three dimensions as a weighted sum of cyclic-exchange cluster integrals. The relative size of each exchange term is then systematically evaluated and its behavior numerically simulated as a function of temperature, density, and particle number. The ground state of the molecular trimer is studied in three dimensions for four potential models: the square-well, the exponential, the Yukawa, and the Gaussian. The exchange symmetries for the boson trimer and for the spin-1/2 and spin-3/2 fermion trimers are treated and incorporated into the trail wavefunctions for these three cases. This distinguishes the energies of these cases. Bounds of the threshold binding parameters are numerically calculated in each case and compared to two-body parameters. Dissert. Abstr.

N76-25073 State Univ. of New York, Stony Brook.
ANALYTIC PROPERTIES OF BOUND STATE WAVE FUNCTIONS Ph.D. Thesis
Christian Sander 1975 155 p
Avail: Univ. Microfilms Order No. 76-11256

The analytic properties of bound state solutions of the integral potential scattering equations of non-relativistic quantum mechanics (Fadeev equations) were studied for a system of three identical, spinless nucleons interacting through separable (Yamaguchi) or local (Yukawa) potentials. The partial wave (S=0) bound state wave function is considered as a function to two complex variables, the magnitudes of the pair and spectator momenta. The locations of poles and branch points are found by an iterative, self-consistent procedure which assumes all singularities of the solution known in Nth order to be present in the integrand of the equation in (N+1)th order. The asymptotic behavior of the two-and three-body bound states and the three-body charge form factor in the momentum variables is found by application of Weinberg's asymptotic theorem. Methods for extracting spectator-pair vertex constants based on the derived analytic structure are outlined. Parameterization of cluster-nucleus vertex functions is suggested. Dissert. Abstr.

N76-25074 New Mexico State Univ., University Park.
APPLICATION OF SEMIQUANTAL THEORY TO ROTATIONAL SPECTRAL LINE SHAPE Ph.D. Thesis
Richard B. Gomez 1975 173 p
Avail: Univ. Microfilms Order No. 76-11168

The semiquantal approach to purely rotational spectral line shape is formulated, tested, and applied. To test the method, the carbonyl sulfide (OCS) linear molecule is used as a trial absorber and is treated as a rigid rotor being perturbed by structureless particles. The collision systems considered are OCS-He, OCS-Ar, and OCS-N2. These systems are used because they have been extensively studied elsewhere and a reasonable intermolecular potential to describe the collision interaction is available. The pure rotational spectral region is considered to avoid the added complications arising from the vibrational degrees of freedom which can be added on later. The relative importance of contributions of the attractive and repulsive anisotropic components of the intermolecular potential used are evaluated. Dissert. Abstr.

N76-25075# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
APPROXIMATION OF SEVERAL PROPERTIES OF WATER,

DIETHYLETHER, POTASSIUM AND MERCURY UP TO THE CRITICAL POINT WITH FUNCTIONS ANALOG TO THOSE USED IN THE THEOREM OF CORRESPONDING STATES
Karlheinz Wagner 17 Nov. 1975 72 p refs In GERMAN; ENGLISH summary
(DLR-FB-75-75) Avail: NTIS HC $4.50; DFVLR, Cologne DM 25,40

It is shown that a very good approximation of liquid density, vapor density, vapor pressure, heat of evaporation, and surface tension is possible up to the critical point, with modified functions, based on the theorem of corresponding states. Individual constants are needed to approximate the properties of the liquids. It is not possible to show that the individual constants are connected with the molecular properties of the fluids, though some constants are similar to one another. The approximation of the vapor density by a four constants function is shown to be feasible. Author (ESA)

N76-25076# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
THEORY OF NONLINEAR PROCESSES Final Technical Report
Elliott W. Montroll 1975 7 p refs
(Contract N00014-67-A-00398-0005; ARPA Order 1806)
(AD-A019097) Avail: NTIS CSCL 20/10

The topics studied in the program on nonlinear process included: Model systems in quantum optics; Nonlinear wave propagation in crystal lattices; Basic studies in nonlinear dynamics; Wave propagation in a Navier-Stokes fluid. This report lists publications resulting from the program. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N76-25077# Committee of the Whole House on the State of the Union (U. S. House).
TIME LIMITS FOR APPLYING FOR RETIREMENT BENEFITS
Washington GPO 1975 27 p Rept. to accompany H.R. 4573, 94th Congr., 1st Sess., 3 Jun. 1975
(H-Rept-94-252) Avail: NTIS Avail: US Capitol, House Document Room

The bill is presented which proposes that: (1) an application by a former employee or member for an annuity or lump-sum credit under the Civil Service Retirement Fund, must be received in the Civil Service Commission before the 115th anniversary of his birth; and (2) an application for a survivor annuity or lump-sum benefits must be received in the Civil Service Commission within 30 years after the death or other event which gives rise to title to the benefit. The bill also proposes 35 technical amendments, all of which update or correct provisions of title 5, United States Code. Author

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-25078# Schwarz (Leroy B.), Rochester, N.Y.
SINGLE CYCLE CONTINUOUS REVIEW POLICIES FOR ARBORESCENT PRODUCTION/INVENTORY SYSTEMS Final Report
Leroy B. Schwarz 30 Oct. 1975 31 p refs
(AD-A018647; Working-Paper-7544) Avail: NTIS CSCL 05/1

In this paper the author examines optimal and near-optimal continuous review policies for a deterministic arborescent inventory system: known and constant outside demand must be met without backlogging or lost sales at minimum average system cost per unit time. Costs are of two types: a fixed order cost at each stage and proportional holding costs on each stage's echelon inventory. The author describes some characteristics of optimal policies and, under fairly mild conditions (e.g., zero initial inventory), prove that the optimal stationary policy is a 'single-cycle' policy. An efficient branch-and-bound algorithm for determining optimal single-cycle policies for arborescent systems is presented. The near-optimality of 'system myopic single-cycle policies' is also examined. GRA

N76-25079# Naval Postgraduate School, Monterey, Calif.
DOD BUDGET DATA ANALYZED BY ROBUST REGRESSION TECHNIQUES
Donald P. Gaver Sep. 1975 32 p refs
(AD-A018296; NPS-55GV75091) Avail: NTIS CSCL 05/1

This paper describes the application of modern robust/resistant regression techniques to DOD data. Sampling experiments to evaluate certain estimating procedures are also summarized. Author (GRA)

N76-25080# Decisions and Designs, Inc., McLean, Va.
MODELING SUBSEQUENT ACTS FOR DECISION ANALYSIS
Rex V. Brown Jul. 1975 43 p refs Sponsored in part by DARPA
(Contracts N00014-75-C-0426; N00014-73-C-0149; NR Proj. 197-031; NR Proj. 197-023)
(AD-A018888; Rept-75-1) Avail: NTIS CSCL 12/1

In this report, a central and commonly adopted convention of applied decision analysis, the 'preposterior model', is critically examined and found dangerous. In addition, some alternative models are explored. Author (GRA)

N76-25081# Stanford Research Inst., Menlo Park, Calif.
AN INTERACTIVE MANAGEMENT SUPPORT SYSTEM FOR PLANNING, CONTROL, AND ANALYSIS
Richard E. Fikes and Marshall C. Pease Nov. 1975 43 p refs
(Contract N00014-71-C-0210)
(AD-A019484; SRI-TR-1031-12) Avail: NTIS CSCL 05/1

A management support system currently being implemented at SRI considers the operational problems faced by the commander of a naval air squadron. It provides a research environment in which to study means of aiding him in planning the use of his resources of pilots, aircraft, maintenance mechanics and facilities, and other limited resources to accomplish missions and other required objectives. It provides a tool for studying how to aid him in controlling the operations, both by identifying events which may require replanning and, where it can, by adjusting operations appropriately. Finally, it provides a facility in which to study how he can analyze and evaluate past operations to improve the squadron's performance. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N76-25082# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 29, NUMBER 11
J. Paul Walsh and Victoria S. Hewitson 30 Nov. 1975 57 p
(AD-A019054; ESN-29-11) Avail: NTIS CSCL 05/2

The monthly publication presents brief articles concerning recent developments in European Scientific Research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications. GRA

N76-25083# Hughes Aircraft Co., Culver City, Calif. Display Systems and Human Factors Dept.
METHODS FOR IMPROVING INFORMATION FROM UNDESIGNED HUMAN FACTORS EXPERIMENTS Technical Report, Jul. 1974 - Jul. 1975
Charles W. Simon Jul. 1975 92 p refs
(Contract F44620-72-C-0086)

(AD-A018455; HAC-P75-287) Avail: NTIS CSCL 05/5

An undesigned experiment is one in which the predictor variables are correlated, either due to a failure to complete a design or because the investigator was unable to select or control relevant experimental conditions. The traditional method of analyzing this class of experiment -- multiple regression analysis based on a least squares criterion -- gives rise to a number of interpretation problems when the effects of individual predictors are to be assessed. Some difficulties and their effects on the quality of information are discussed. Two methods are described in this report for improving the information obtained from the undesigned human factors experiment. One is to collect more information at a few data points selected at locations that improve the orthogonality of this nonorthogonal design. The other is to use a ridge regression analysis in place of the conventional least squares analysis, in which a slight bias is introduced into the data in such a way that the combined bias and variance error is smaller than the variance error of unbiased estimates from the least squares analysis. The ridge analysis produces more stable and meaningful regression coefficients. Computational aids, both references and complete computer programs, are supplied.
Author (GRA)

N76-25084# Machinability Data Center, Cincinnati, Ohio.
ANNUAL REPORT (11TH) OF THE MACHINABILITY DATA CENTER
John F. Kahles and John L. Krebs Oct. 1975 47 p Prepared in cooperation with Metcut Res. Assoc.
(Contract DSA900-75-C-2071)
(AD-A018319; AMMRC-CTR-75-24) Avail: NTIS CSCL 05/2

The Machinability Data Center (MDC) is one of a number of Information Analysis Centers sponsored by the Department of Defense. By disseminating machining data and related information, MDC functions to decrease the cost of machining and increase the productivity and reliability of machined products in behalf of the Department of Defense, and other U.S. Government agencies and their contractors. In view of the size and distribution of the machining industry and its impact on productivity, MDC data has considerable influence in the private sector as well. The specific functions of MDC include the collection, evaluation, storage and dissemination of information pertaining to material removal technology. This is the Eleventh Annual Report covering activities of the Machinability Data Center during the period from August 1, 1974 to July 31, 1975. GRA

N76-25085# Informatics, Inc., Rockville, Md.
SOVRaD: A DIGEST OF RECENT SOVIET R AND D ARTICLES, VOLUME 1, NUMBER 11, 1975
Stuart G. Hibben, Lee Boylan, J. Kourilo, B. Shresta, and M. Ness Nov. 1975 16 p
(Contract MDA903-76-C-0099; DARPA Order 3097)
(AD-A018543) Avail: NTIS CSCL 05/2

This is a collection of brief abstracts on miscellaneous topics from the current Soviet technical literature. The intent is to supply a quick look at items of possible interest, including topics not necessarily named in the DARPA interest profile, as a supplement to our reportage on specified topics. It is intended to publish this collection on a monthly basis, to continue to provide prompt coverage of numerous aspects of Soviet R and D. As an added feature, all recently acquired books will be listed as they are received. A list of source abbreviations is appended.
Author (GRA)

N76-25086# Purdue Univ., Lafayette, Ind. Center for Information and Numerical Data Analysis.
THERMOPHYSICAL AND ELECTRONIC PROPERTIES INFORMATION ANALYSIS CENTER TEPIAC, A CONTINUING SYSTEMATIC PROGRAM ON TABLES OF THERMOPHYSICAL AND ELECTRONIC PROPERTIES OF MATERIALS Final Report, 8 Oct. 1974 - 30 Sep. 1975
Cho-Yen Ho Oct. 1975 106 p
(Contract DSA900-75-C-3951)
(AD-A018473; AMMRC-CTR-75-27) Avail: NTIS CSCL 05/2

This Final Report describes the activities and accomplishments of the Thermophysical and Electronic Properties Information Analysis Center (TEPIAC) in the period 8 October 1974 to 30 September 1975. TEPIAC's activities reported herein include literature search, acquisition, and input of source information; document review and codification and substance classification; operation of a computerized information storage and retrieval system; preparation and publication of the Thermophysical Properties Research Literature Retrieval Guide Supplement; data extraction and compilation; data evaluation, correlation, analysis, synthesis, and generation of recommended values; preparation and publication of the Thermophysical Properties of Matter - The TPRC Data Series, state-of-the-art reports, and critical reviews; technical and bibliographic inquiry services; and current awareness and promotion efforts. GRA

N76-25087 Institution of Electrical Engineers, London (England).
TOWARDS AUTOMATIC INDEXING. 1. RELATIONSHIP BETWEEN FREE AND CONTROLLED LANGUAGE INDEXING AND THE AUTOMATIC GENERATION OF CONTROLLED SUBJECT HEADINGS AND CLASSIFICATIONS
B. J. Field Apr. 1975 74 p refs
(BLL-RD-5235-(2113.56F); R75-20) Avail: British Library Lending Div., Boston Spa, Engl.

Various methods were studied for investigating and displaying the relationships between free-indexing terms, controlled subject headings and classifications. These methods involved the ranking of one type of indexing element with respect to another using a statistically-generated adhesion coefficient to reflect the degree of association between the free-indexing terms, the controlled subject headings, and the classification. As a result, a number of techniques and computer programs were developed to automatically generate controlled subject headings, and classifications from free indexing. These techniques involved the automatic truncation and manipulation of free-index phrases and the use of a manually-constructed thesaurus, together with statistical ranking and weighing methods. The accuracy and cost-effectiveness of the automatically-assigned subject headings and classifications produced by these methods was compared with those of the manual system. The results were encouraging and the costs comparable to those of a manual system. Author

N76-25088 British Library Lending Div., Boston Spa (England).
THE ROLE OF REVIEWS IN INFORMATION TRANSFER IN SCIENCE
A. M. Woodward Oct. 1975 35 p refs
(BLL-RD-5234-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

Following a general discussion of reviews, and particularly of the problem of adopting a suitable definition, the literature on user studies, both of reviews and scientific literature in general, is briefly and selectively surveyed. Some preliminary investigations are reported. Reviews appear to fulfill two interlocking roles, that of forming an essential part of the development of science (historical functions) and that of supplying individual workers with information about the current development of science and its supporting literature (contemporary functions). These two roles are reflected in two broad methodologies proposed for the study of the roles of reviews: a bibliometric study of the historical importance of reviews using citation data obtainable from the Science Citation index and a user survey to study the usefulness and importance of reviews to the individual scientist. Suggestions for a concerted programme of research into reviews are also made. Author

N76-25103 Connecticut Univ., Storrs. New England Research Application Center.
MAXIMIZING USER BENEFIT FROM A TECHNICAL INFORMATION CENTER
Daniel U. Wilde *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 3 p (For availability see N76-25098 15-85)

N76-25104 Dansk Teknisk Oplysningstjeneste, Copenhagen.
THE INFLUENCE OF INFORMATION FLOW ON THE ORGANIZATION OF AN ENTERPRISE
Kjeld Klintoe *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 9 p refs (For availability see N76-25098 15-85)

N76-25105 United Nations Educational, Scientific and Cultural Organization, Paris (France). International Social Science Council.

ON THE USE OF QUANTITATIVE DATA IN INFORMATION SCIENCE
Eric DeGrolier *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 9 p refs (For availability see N76-25098 15-85)

N76-25106 Studiengruppe fuer Systemforschung, Heidelburg (West Germany).
THE CHARACTERISTICS REQUIRED TO MAKE A GOOD INFORMATION SPECIALIST
Werner Kunz *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 4 p refs (For availability see N76-25098 15-85)

N76-25107 Danish Atomic Energy Commission, Risoe.
INFORMATION UTILIZATION IN GOVERNMENT RESEARCH INSTITUTIONS: AN ATTEMPT AT A USER-ORIENTED APPROACH
Eva Pedersen *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 3 p refs (For availability see N76-25098 15-85)

N76-25108 Victoria State Coll., Hawthorn (Australia).
USER RESPONSE TO THE SDI SERVICE DEVELOPED AT AERONAUTICAL RESEARCH LABORATORIES, AUSTRALIA
Margaret O. Sheppard *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 9 p refs (For availability see N76-25098 15-85)

N76-25113 Georgetown Univ., Washington, D.C.
THE GATEKEEPER HYPOTHESIS AND THE INTERNATIONAL TRANSFER OF SCIENTIFIC KNOWLEDGE
Arnold J. Herzog *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 9 p refs (For availability see N76-25098 15-85)

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-25089# Royal Naval Personnel Research Committee, London (England).
A SOURCE OF BIAS IN HUMAN ENGINEERING RESEARCH
E. C. Poulton Mar. 1974 8 p refs
(AD-A019318; OES-7/74) Avail: NTIS CSCL 05/5

In a within subject experimental design, each person receives a number of conditions in a balanced or random order. The design produces asymmetrical transfer and range effects. Yet practically all human engineering recommendations are based upon the results of experiments which use this kind of design. The recommendations need to be checked, using separate groups of people for each experimental condition. GRA

N76-25090# Sperry Univac, St. Paul, Minn. Defense Systems Div.
PROSODIC AIDS TO SPEECH RECOGNITION. 7: EXPERIMENTS ON DETECTING AND LOCATING PHASE BOUNDARIES Final Technical Report, 1 Sep. 1974 - 31 Aug. 1975
Wayne A. Lean 14 Nov. 1975 53 p refs
(Contract DAHC15-73-C-0310; ARPA Order 2010)
(AD-A019047; PX-11534) Avail: NTIS CSCL 05/7

Computer programs for detecting syntactic boundaries (BOUND3) and locating stressed syllables (STRESS) have been supplied to ARPA contractors and incorporated into speech recognition facilities. Experiments were conducted on various timing cues that correlate with phonological and syntactic phrase boundaries, showing that 91% of the phonological phrase boundaries that were perceived by listeners who heard spectrally inverted speech could be detected from lengthened vowels and sonorants in phrase-final positions. Also, 95% of these perceived boundaries were evidenced by long time intervals between syllables. The interstress interval also provided a good measure of rate of speech, that correlated with error rates in automatic phonetic classification schemes. GRA

N76-25091# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
ASSESSMENT OF SIMPLE JOINT TIME/RISK PREFERENCE FUNCTIONS Technical Report, 1 May 1973 - 30 Jun. 1975
Stephen Manuel Barrager Aug. 1975 31 p refs
(Contract N00014-67-A-0112-0077; Grant NSF GK-36491; ARPA Order 2449)
(AD-A018642; EES-DA-75-6) Avail: NTIS CSCL 05/3

This article outlines a procedure for assessing a decision maker's cardinal utility function U(x sub 1,...,x sub i,...,x sub N) where x sub i is the payoff in the (i) (th) period of an N-period future. The function U(x) captures the decision maker's time preferences (his willingness to trade off payoffs between time periods) and his risk preferences (his attitude toward risk taking). The procedure outlined uses a straightforward but little known two-step method for assessing multiattribute utility. In the first step the decision maker is asked to reveal time preferences by choosing between sure payoff vectors. In the second step attitude toward uncertainty is measured by encoding risk aversion on an appropriate single-dimensional index. The two steps are combined mathematically to produce the utility function. A new preference parameter is introduced. The parameter, called the coefficient of variation aversion, is a measure of how strongly an individual feels about undesirable variations in payoff vectors. It is shown that the coefficient of variation aversion exists and is strictly positive if the ordinal preference function has an additive representation and preferences satisfy a reasonable set of axioms. GRA

N76-25092# Stanford Research Inst., Menlo Park, Calif.
DEPARTMENT OF DEFENSE MATERIALS CONSUMPTION AND THE IMPACT OF MATERIAL AND ENERGY RESOURCE SHORTAGES Final Report, Oct. 1974 - Nov. 1975
Mark D. Levine and Irving W. Yabroff Nov. 1975 160 p refs
(Contract DAAH01-75-C-0173; ARPA Order 2865)
(AD-A018613) Avail: NTIS CSCL 05/3

The purpose of this research was twofold: (1) to develop estimates of the amount of each of 17 critical materials consumed by U.S. industry to supply DOD final demand and to describe their direct and indirect flow through industry and (2) to analyze potential economic impacts of a shortage of one or more of these materials. Material consumption and flow analysis was performed for the following materials: aluminum, chromium, coal, cobalt, copper, lead, natural gas, nickel, petroleum, platinum, silver, tin, titanium metal, titanium pigment, tungsten, zinc castings, and zinc galvanizing. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-25093# Committee of Conference (U. S. Congress).
NASA AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1976 AND TRANSITION PERIOD
Washington GPO 1975 13 p Conference Rept. to accompany H.R. 4700, 94th Congr., 1st Sess., 4 Jun. 1975
(H-Rept-94-259) Avail: US Capitol, House Document Room

An amendment to the proposed legislative appropriations bill for NASA projects is presented. The budget is subdivided into Research and Development, facility construction, and research and program management categories. The largest share of monies are allocated for the space shuttle program. A.S.K.

N76-25094# Committee on Interior and Insular Affairs (U. S. Senate).
ENERGY SUPPLY ACT OF 1974
Washington GPO 1974 159 p refs Rept. together with minority views to accompany S. 3221, 93d Congr.,
(S-Rept-93-1140) Avail: US Capitol, Senate Document Room

2d Sess., 9 Sep. 1974

A final report of the Senate Committee on Interior and Insular Affairs regarding proposed legislation regulating offshore energy exploration on the outer continental shelf is presented. The environmental effects on coastal regions from offshore drilling are discussed and the state of the art in offshore oil and gas extraction technology is analyzed. The economic and legal problems involved in government leasing of well sites are discussed. The full text of the proposed legislation is also presented. A.S.K.

N76-24247 European Space Agency, Paris (France).
AIRCRAFT NOISE LIMITS
Friedrich Karl Franzmeyer *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 54-68 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 49-65 (For availability see N76-24243 15-07)

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N76-25095# RAND Corp., Santa Monica, Calif.
SCIENCE AND TECHNOLOGY IN JAPAN: A BRIEF ANALYTIC SURVEY
Ed McGaffigan and Paul Langer Nov. 1975 190 p refs
(Contract DAHC15-73-C-0181; ARPA Order 1891)
(AD-A019245; R-1736-ARPA) Avail: NTIS CSCL 05/3

The report is an exploration of the strengths and weaknesses of Japanese science and technology, including an estimate of the importance of foreign technology to Japanese technological advancement and an examination of the power of Japanese business management and government policy over scientific and technological development. Possible areas for U.S.-Japanese collaboration are identified. Today government policy in Japan is to concentrate on and to invest more R and D funds in 'knowledge intensive' areas, such as computers, fine chemicals, nuclear energy, semiconductors, and other industries where significant levels of R and D expenditures are required to compete on world markets. Projects chosen aim at satisfying long-term national and industrial needs. GRA

N76-25096# Department of Transportation, Washington, D.C.
TECHNOLOGY SHARING: A GUIDE TO ASSISTANCE IN OBTAINING AND USING RESEARCH, DEVELOPMENT AND DEMONSTRATION OUTPUTS Final Report
Jan. 1976 80 p refs
(PB-249101/7; DOT-TST-76-51) Avail: NTIS HC $5.00 CSCL 13F

Information is provided on the policy and general approach to technology sharing, an overview of the sharing/assistance mechanisms, the specific mechanisms and activities of the various operating administrations, and interagency programs aimed at improving federal coordination. Programs are broken out in four general categories: field support and direct assistance, information services, training programs, and RD&D programs. Appendices are included which provide information on grant and financial assistance which is available, intergovernmental personnel and training, excerpts from the policy statement, and a summary chart of the programs contained in the report. GRA

N76-25097# Transportation Research Board, Washington, D.C.
LIGHT RAIL TRANSIT: PROCEEDINGS OF A NATIONAL CONFERENCE CONDUCTED BY THE TRANSPORTATION RESEARCH BOARD
James R. Mills, Lee H. Rogers, C. Kenneth Orski, Frank C. Herringer, and J. William Vigrass 1975 184 p refs Conf. held at Philadelphia, 23-25 Jun. 1975; sponsored by Urban Mass Transportation Admin., Am. Public Transit Assoc., Penna. Univ.
(PB-249150/4; TRB/SR-161; ISBN-0-309-02370-X) Avail: NTIS HC $7.50 CSCL 13B

The papers in this Special Report were prepared for and delivered at the National Conference on Light Rail Transit held in Philadelphia, Pa., June 23-25, 1975. They cover a wide range of subjects related to light rail transit. Included are a description of system concepts, such as performance characteristics of light rail transit; comparison with other modes; and applications. Included also is a set of papers that address permanent way requirements, electrification and control systems, and U.S. and foreign vehicle development. Also, a number of papers discuss the various costs of construction, operation, and maintenance as well as social costs and benefits. GRA

N76-25098# Advisory Group for Aerospace Research and Development, Paris (France).
THE PROBLEM OF OPTIMIZATION OF USER BENEFIT IN SCIENTIFIC AND TECHNOLOGICAL INFORMATION TRANSFER
Mar. 1976 116 p refs Presented at Tech. Inform. Panel Specialists' Meeting, Copenhagen, 8-9 Oct. 1975
(AGARD-CP-179; ISBN-92-835-1213-8) Avail: NTIS HC $5.50

The user/information service interface is examined and user problems are defined particularly for aerospace, scientific, and technical information. Topics discussed include: role of communication and direct personal communication in the transfer of technology; influence of information flow on the organization of an industry or research and development institution; information utilization in government and industry research institutions; and user requirements in the various fields. For individual titles, see N76-25099 through N76-25114.

N76-25099 Association of Special Libraries and Information Bureaux, London (England).
THE ROLE OF COMMUNICATION IN TECHNOLOGICAL INNOVATION
John Martyn *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 3 p refs (For availability see N76-25098 15-85)

Communication is described as a two-way process, involving the active participation of both the originator and recipient of a communication. Results of various studies are reviewed indicating that good communications, internal and external, characterize organizations which are successful technological innovators. It is concluded that responsibility for the establishment of good formal (information services) and informal (person to person) communication and information flow rests with management. Author

N76-25100 Massachusetts Inst. of Tech., Cambridge. Sloan School of Management.
THE IMPORTANCE OF DIRECT PERSONAL COMMUNICATION IN THE TRANSFER OF TECHNOLOGY
Thomas J. Allen *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 10 p refs (For availability see N76-25098 15-85)

Technical communication in industrial firms is discussed. Heavy reliance upon face-to-face communication to transfer technology in industry, and interpersonal contacts among scientists, both domestic and foreign, to foster national and international transfer of technology are emphasized. Effective management of information flow for technology acquisition and dissemination is considered. J.M.S.

N76-25101 National Research Council of Canada, Ottawa (Ontario). Technical Information Service.
TECHNOLOGICAL UP-DATING FOR THE MANUFACTURING INDUSTRY
Gerard Kirouac *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 3 p refs (For availability see N76-25098 15-85)

Information services designed to keep the manufacturing industry technologically up-dated are described. Author

N76-25102 Nord-Video, Stockholm (Sweden).
ALTERNATIVE MEDIA FOR INFORMATION TRANSFER
Bengt-Arne Vedin *In* AGARD The Probl. of Optimization of

User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 5 p (For availability see N76-25098 15-85)

Different factors affect the medium to be chosen for the transmission of a message: receiver needs, message contents, channels available, costs, necessity of retrieval, etc. A method for comparing different media is outlined, and the impact or efficiency of different appeals to our senses are reviewed. The analysis is also applied to new media just being introduced.

Author

N76-25103 Connecticut Univ., Storrs. New England Research Application Center.

MAXIMIZING USER BENEFIT FROM A TECHNICAL INFORMATION CENTER **c82**

Daniel U. Wilde *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 3 p (For availability see N76-25098 15-85)

Dissemination of the results of NASA research to business and industry, colleges and universities, and state and local governments is discussed. The New England Research Application Center's operating procedures and efforts to increase user benefits and thus ensure successful technology transfer are reviewed.

J.M.S.

N76-25104 Dansk Teknisk Oplysningstjeneste, Copenhagen.

THE INFLUENCE OF INFORMATION FLOW ON THE ORGANIZATION OF AN ENTERPRISE **c82**

Kjeld Klintoe *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 9 p refs (For availability see N76-25098 15-85)

The concept of an enterprise, the role of information, and how the information flow could be organized to make an impact on the performance and result of the operations of an enterprise are discussed.

Author

N76-25105 United Nations Educational, Scientific and Cultural Organization, Paris (France). International Social Science Council.

ON THE USE OF QUANTITATIVE DATA IN INFORMATION SCIENCE **c82**

Eric DeGrolier *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 9 p refs (For availability see N76-25098 15-85)

The development of information science is briefly considered. Emphasis is placed on the pitfalls encountered in constructing an information system, and suggestions are presented for future research.

J.M.S.

N76-25106 Studiengruppe fuer Systemforschung, Heidelburg (West Germany).

THE CHARACTERISTICS REQUIRED TO MAKE A GOOD INFORMATION SPECIALIST **c82**

Werner Kunz *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 4 p refs (For availability see N76-25098 15-85)

From the current situation and the nature of problems in the information sciences, the different kinds of information scientists demanded are described. A number of tasks that may be performed by information scientists are listed. Topics to be taught are identified, and proposals are made for organizing the educational course structure for information scientists. Author

N76-25107 Danish Atomic Energy Commission, Risoe.

INFORMATION UTILIZATION IN GOVERNMENT RESEARCH INSTITUTIONS: AN ATTEMPT AT A USER-ORIENTED APPROACH **c82**

Eva Pedersen *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 3 p refs (For availability see N76-25098 15-85)

The importance of close cooperation between the research worker and the research library is examined. The requirements to the library from a user point of view are discussed. Direct access for scientists to on-line data bases is stressed, but the human element is advocated as being more important than computerized services.

Author

N76-25108 Victoria State Coll., Hawthorn (Australia).

USER RESPONSE TO THE SDI SERVICE DEVELOPED AT AERONAUTICAL RESEARCH LABORATORIES, AUSTRALIA **c82**

Margaret O. Sheppard *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 9 p refs (For availability see N76-25098 15-85)

A computer-based SDI system developed at the Aeronautical Research Laboratories, Australia, using an unsophisticated search logic, has been operating and developing for nearly five years interrogating ADSATIS and U.S. NTIS GRA magnetic tapes for over 130 research oriented users. An analysis was made of use statistics. The response to a recent questionnaire concerning information gathering habits of ARL research staff and the role of ARL SDI service within the overall pattern of information seeking is discussed in some detail. As a result, it is considered that an ARL type SDI system can be recommended when the system is designed to serve scientific research staff in what may be regarded as a fairly typical research establishment. Once in operation, an ARL type SDI system can be elaborated for those who require a more sophisticated service, but experience at ARL suggests that the needs of the majority will be met by the simpler SDI service.

Author

N76-25109* National Aeronautics and Space Administration, Washington, D.C.

LISTENING TO THE USER: A CASE STUDY

Harold E. Pryor *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 7 p (For availability see N76-25098 15-85)

The managers of the NASA Scientific and Technical Information System consistently maintain that whatever scientific and technical information services and products are provided must be geared primarily to user needs and not simply system compatibility and convenience. A system evaluation study begun in 1973 and continued to the present is described. The thrust of this on-going examination is to regularly evaluate the usefulness of the present information system to those it is intended to serve, engineers and scientists working in their professional roles, and to identify areas and ways in which the system can be made more responsive to user needs. Techniques used have covered the range from personal, in-depth interviews to widely distributed questionnaires. The findings have been positive. Many refinements made to on-going programs and projects and new endeavors begun in direct response to stated user needs are discussed. In the main these needs are not unreasonable and thus can be responded to with cost effective system modifications.

Author

N76-25110 Department of Industry, London (England). Research Contractors Div.

INFORMATION REQUIREMENTS OF ENGINEERING DESIGNERS

J. R. Sutton *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 8 p refs (For availability see N76-25098 15-85)

The information requirements of engineering designers are examined in the light of several surveys. The information requirements of mechanical engineers differ from those of scientists and the information requirements of designers differ from those of other mechanical engineers. Some of the results of a survey of information requirements of engineering designers are reported. Designers prefer familiar and convenient sources of information.

Author

N76-25111 Brown, Boveri und Cie, A.G., Mannheim (West Germany). Zentralstelle fuer Technische Dokumentation.

INDUSTRY DOCUMENTATION: A NECESSARY EVIL

Werner Diers *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 10 p refs (For availability see N76-25098 15-85)

Documentation of technical and scientific literature in industry in the Federal Republic of Germany is discussed in terms of user needs. The advantages of a centralized, computerized documentation center are reviewed.

J.M.S.

N76-25112 Norwegian Center for Informatics, Oslo.

THE VOICE OF THE USER: HIS INFORMATION NEEDS AND REQUIREMENTS (WHICH ARE NOT WHAT THE INFORMATION SPECIALISTS THINK THEY ARE)

A. Disch *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 8 p refs (For availability see N76-25098 15-85)

Two user studies were carried out in Norway. In the first one 1,400 engineers were asked to list those information sources that they had used lately and which had proved to be of practical value in their daily work. The follow-up study was a detailed study of the information gathering habits of a limited number of users. It was found in both studies that the traditional information channels were of little value to the practical user. Two attempts to remedy these findings are described. Author

N76-25113 Georgetown Univ., Washington, D.C.
THE GATEKEEPER HYPOTHESIS AND THE INTERNATIONAL TRANSFER OF SCIENTIFIC KNOWLEDGE c82
Arnold J. Herzog *In* AGARD The Probl. of Optimization of User Benefit in Sci. and Technol. Inform. Transfer Mar. 1976 9 p refs (For availability see N76-25098 15-85)

The transfer of information across international boundaries is discussed. Interpersonal contacts, both domestic and foreign are considered the means of diffusing information from the industrial community and the scientific community. Economic factors are included. J.M.S.

N76-25114 Advisory Group for Aerospace Research and Development, Paris (France).
APPLYING THE USER/SYSTEM INTERFACE ANALYSIS RESULTS TO OPTIMIZE INFORMATION TRANSFER Summary of Panel Discussion
E. T. Sharp, ed. (Shape Technical Centre) *In its* The Probl. of Optimization of User Benefit in Sci. and Techol. Inform. Transfer Mar. 1976 10 p (For availability see N76-25098 15-85)

A summary is provided of the highlights of the various papers presented. Topics covered include: the role of communication in technological innovation, the importance of direct communication, user requirements, and the market in which the information service should operate. A general discussion of issues is included. J.M.S.

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-25115*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMOGENIC RADIONUCLIDES IN STONE METEORITES
Philip J. Cressy, Jr. Washington May 1976 31 p refs
(NASA-TN-D-8241; G-7658) Avail: NTIS HC $4.00 CSCL 03A

This document presents the techniques and compilation of results of cosmogenic Al-26 measurements at Goddard Space Flight Center on 91 samples of 76 stone meteorites. Short-lived radionuclides, including Na-22, Sc-46, Mn-54, and Co-60, were measured in 13 of these meteorites. About one-third of these data has not previously been published. The results are discussed briefly in terms of (1) depletion of Al-26 and natural potassium due to weathering, (2) possible exposure of several chondrites to an unusually high cosmic-ray flux, (3) comparison of Al-26, Na-22, Sc-46, and Mn5-54 in chondrites with the spallation Ne-22/Ne-21 ratio as a shielding indicator, and (4) comparison of (Al-26)-(Ne-22)/Ne-21 data for achondrite classes with the chondrite trend. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-25116*# Kanner (Leo) Associates, Annapolis, Md.
POWERFUL GALACTIC MASERS
V. V. Burdyuzha, D. A. Varshalovich, and T. V. Ruzmaykina Washington NASA Jun. 1976 27 p refs Transl. into ENGLISH of "Moshchnyye galakticheskiye mazery", Rept. Pr-246 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1975 27 p
(Contract NASw-2790)
(NASA-TT-F-17056) Avail: NTIS HC $4.00 CSCL 03B

A study is made of certain problems of the astrophysics of galactic masers: pumping mechanisms, the nature of master condensation and polarization properties. Author

N76-25117# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
STRUCTURE OF ROTATIONAL LEVELS AND MECHANISMS OF INTERSTELLAR MOLECULE CH EXCITATION
V. V. Burdjuzha, B. I. Zhilinsky, and A. A. Reitblat 1975 34 p refs
(PR-236) Avail: NTIS HC $4.00

The peculiarities of the structure of rotational level of the CH-molecule detected in H I and H II galactic region radio-frequency emission, as well as its mechanisms of excitation, are dealt with. It is shown that in the 2 Pi 1/2 CH state, the anomalous variation of Kronig symmetry takes place in transition from rotational lambda-doublet J 1/2 to lambda-doublet J 3/2. The hyperfine constants and lambda-doubling constants are determined. Mechanisms of rotational sublevel excitation are discussed and observational results presented. ESA

N76-25118# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
THE LIMITING LUMINOSITY OF ACCRETING NEUTRON STARS WITH MAGNETIC FIELDS
M. M. Basko and R. A. Sunyaev 1975 50 p refs
(PR-243) Avail: NTIS HC $4.00

The accretion onto a magnetized neutron star in cases of high accretion rates is discussed. The equation of hydrodynamics and radiative diffusion are solved in a one-dimensional approximation; the solution is expressed in an analytical form. The limiting X-ray luminosity of accreting magnetized neutron stars is shown to depend crucially on the geometry of the accretion channel. Under certain conditions the value of X-ray luminosity may exceed the critical Eddington value, the main energy flux being carried out with neutrons. The effects connected with the gas flow along the magnetospheric surface are discussed. The plasma layer on the Alfven surface is shown to be optically thick with respect to Thomson scattering and to reradiate in soft X-rays considerable fraction of the primary X-ray flux. A necessary condition for the X-ray luminosity to exceed the Eddington limit is a certain degree of asymmetry in the distribution of matter over the Alfven surface. In the framework of the model adopted regular pulsations of hard and soft X-rays are discussed.
Author (ESA)

N76-25119# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Kernphysik.
MATTER IN SUPERSTRONG MAGNETIC FIELDS AND THE STRUCTURE OF A NEUTRON STAR'S SURFACE
W. Hillebrandt and E. Mueller Aug. 1975 12 p refs Supported in part by Deut. Forschungsgemeinschaft
(IKDA-75/22) Avail: NTIS HC $3.50

The properties of matter in strong and superstrong magnetic fields (B in the range of 5 x 10 to the 11th power to 10 to the 13th power Gauss) are reconsidered. By slightly improving and correcting previous calculations it is shown that molecular chains are only slightly bound with respect to free atoms. For B = 10 to the 12th power Gauss the cohesive energy is 0.07 keV and 0.19 keV for iron and carbon respectively. Only at extremely high magnetic fields (B greater than or equal to 5 x 10 to the 14th power Gauss), which are probably not present in pulsars, strong binding is obtained (greater than 10 keV).
Author (ESA)

N76-25120*# Owens Valley Radio Observatory, Pasadena, Calif.
OBSERVATIONS OF HEAVY-ELEMENT RECOMBINATION LINES IN THE RHO OPHIUCHI DARK CLOUD AT 13 cm WAVELENGTH
G. R. Knapp, T. B. H. Kuiper (JPL), and Robert L. Brown (Natl. Radio Astronomy Obs.) 1975 20 p refs Sponsored in part by NASA
(Contract N00014-67-A-0094-0019; Grant NSF GP-30400-X1) (NASA-CR-146929; AD-A018646; Rept-1975-17) Avail: NTIS HC $3.50 CSCL 03/2

High-sensitivity observations at the carbon 140 alpha and 141 alpha recombination line frequencies in the direction of the Rho Ophiuchi dust cloud show the presence of recombination lines of carbon and sulfur, but not of other heavy elements. These results require: that the elements Si, Fe and Mg are depleted by factors greater than 15, 10 and 2 respectively, most likely into interstellar grains, whereas sulphur is undepleted: and that only approximately 1/6 of the carbon is present in the gas phase in the cloud. From the observed size of the CII region, theta is approximately equal to 3.2 arcmin, together with the observed carbon depletion, the authors infer that the density in the carbon-line-emitting region is n(H) approximately equal to 25,000/cc, and that the size of the SII region is significantly larger than that of CII region. The agreement between the widths of the recombination lines (which arise in a small region of the cloud) and those of the more widely distributed molecular species suggests that the lines in this cloud are broadened by microturbulence on a scale much 0.1 parsecs. GRA

N76-25131* Academy of Sciences (USSR), Moscow. Inst. of Radio Engineering and Electronics.
SOME RESULTS OF CISLUNAR PLASMA RESEARCH
A. S. Vyshlov, N. A. Savich, M. B. Vasilyev, L. N. Samoznaev, A. I. Sidorenko, and D. Ya. Shtern *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 81-85 refs (For availability see N76-25125 15-91)
CSCL 03B

N76-25137* Academy of Sciences (USSR), Moscow. Space Research Inst.
NUMERICAL SIMULATION OF THE EFFECTS OF MAGNETIC FIELD INDUCED BY PLASMA FLOW PAST NONMAGNETIC PLANETS
A. S. Lipatov *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 151-158 refs (For availability see N76-25125 15-91)
CSCL 03B

N76-25139* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE QUESTION OF THE ENERGY OF THE PRECESSIONAL DYNAMO
Sh. Sh. Dolginov (IZMIRAN, Akademgorodok, Moscow) *In its* Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 167-170 refs (For availability see N76-25125 15-91)
CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-25121* National Aeronautics and Space Administration, Washington, D.C.
VIKINGS CONVERGE ON MARS
1976 123 p
(NASA-News-Release-76-103; P76-10101) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

The scientific goals of the Viking mission are described. The science investigations to be carried out are explained and a timetable of planetary operations is outlined. Descriptions of the Viking orbiter and lander systems are presented including explanations of the Viking experimental instrument subsystems. A.S.K.

N76-25122*# Scientific Translation Service, Santa Barbara, Calif.
A WORKING MODEL OF THE ATMOSPHERE AND SURFACE OF MARS. PART 1: ATMOSPHERE
V. I. Moroz, ed. Washington NASA May 1976 70 p refs Transl. into ENGLISH of "Rabochaya model atmosfery i poverkhnosti marsa. Chast 1: Atmosfera", Rept. Pr-240 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1975 p 1-68
(Contract NASw-2791)
(NASA-TT-F-17029) Avail: NTIS HC $4.50 CSCL 03B

A model of the Mars atmosphere is discussed which takes into consideration temperature profiles, circulation characteristics (including the occurrence of high winds and dust storms), surface pressure, chemical composition and the atmospheric boundary layer. D.M.L.

N76-25123*# Scientific Translation Service, Santa Barbara, Calif.
A WORKING MODEL OF THE ATMOSPHERE AND SURFACE OF MARS. PART 2. SURFACE
V. I. Moroz Washington NASA May 1976 26 p refs Transl. into ENGLISH of "Rabochaya Model Atmosfery i Poverkhnosti Marsa, Chast 2. Poverkhnost" Moscow, Inst. of Space Res., Acad. of Sci. USSR, Rept. Pr-241, 1975 p 1-25
(Contract NASw-2791)
(NASA-TT-F-17028; Pr-241) Avail: NTIS HC $4.00 CSCL 03B

A model is proposed for the surface of Mars. The shape of the planet, and the surface coordinate system are discussed. General surface characteristics, the mesorelief, photometric characteristics, adn surface temperature are described. Author

N76-25124*# Kanner (Leo) Associates, Redwood City, Calif.
THE STRUCTURE OF THE MARTIAN SOIL ACCORDING TO OPTICAL AND INFRARED OBSERVATIONS
V. I. Moroz Washington NASA May 1976 27 p refs Transl. into ENGLISH of "O Strukture Marsianskogo Grunta po Opticheskim i Infrakrasnym Nablyudeniyam" Moscow, Inst. of Space Res., Acad. Sci. USSR, Rept. Pr-234, 1975 p 1-27
(Contract NASw-2790)
(NASA-TT-F-17027; PR-234) Avail: NTIS HC $4.00 CSCL 03B

The reflection spectrum and thermal properties of the Martian soil are consistent with the following model: (1) the Martian soil consists of particulate igneous rock, both basic and intermediate, the soil of the bright areas being more acidic than that of the dark areas; (2) the soil consists of two types of particle: comparatively large particles (tenths of a millimeter in size) and particles micrometer in size; the larger particles may well be conglomerates of the smaller particles; (3) the mean soil density is approximately 1.22 g cm/3 at a depth of two to four cm, with a porosity of about 0.6. Author

N76-25125*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR-WIND INTERACTION WITH THE PLANETS MERCURY, VENUS, AND MARS
Norman F. Ness, ed. Washington 1976 172 p refs Presented at Proc. of a Bilateral Seminar of the US/USSR Joint Working Group on Near-Earth Space, the Moon, and Planets, Moscow, 17-21 Nov. 1975
(NASA-SP-397) Avail: NTIS HC $6.25 CSCL 03B

Magnetic field and plasma measurements in the environments of the planets Mars, Mercury, and Venus are reported. For individual titles, see N76-25126 through N76-25139.

N76-25126* Academy of Sciences (USSR), Moscow. Inst. of Terrestrial Magnetism and Radiowave Propagation.
MAGNETIC FIELD AND PLASMA INSIDE AND OUTSIDE OF THE MARTIAN MAGNETOSPHERE
Sh. Sh. Dolginov, Ye. G. Yeroshenko, L. N. Zhuzgov, V. A. Sharova, K. I. Gringauz, V. V. Bezrukikh, T. K. Breus, M. I. Verigin, and A. P. Remizov *In* NASA. Goddard Space Flight Center Solar-Wind

Interaction with the Planets Mercury, Venus, and Mars 1976 p 1-20 refs (For availability see N76-25125 15-91)
CSCL 03B

Simultaneous magnetic and plasma measurements, carried out by wide angle plasma detectors in the Mars environment, are compared in order to identify regions with significantly different physical properties. Magnetograms and ion spectra indicate changes in the magnetopause and magnetosphere of Mars that are associated with the dynamic pressure effect of the solar wind. G.G.

N76-25127* Academy of Sciences (USSR), Moscow. Space Research Inst.
ON THE NATURE OF THE SOLAR-WIND-MARS INTERACTION **c92**
O. L. Vaisberg, A. V. Bogdanov, V. N. Smirnov, and S. A. Romanov *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 21-40 refs (For availability see N76-25125 15-91)
CSCL 03B

Plasma measurements near Mars on the U.S.S.R. Mars-2, -3, and -5 spacecraft are considered. The data are compared with simultaneous magnetic measurements. Strong evidence is obtained in favor of a direct interaction and mass exchange between the solar wind plasma and the gaseous envelope of Mars. Author

N76-25128* Academy of Sciences (USSR), Moscow. Inst. of Radio Engineering and Electronics.
THE NIGHTTIME IONOSPHERE OF MARS FROM MARS-4 AND MARS-5 RADIO OCCULTATION DUAL-FREQUENCY MEASUREMENTS
N. A. Savich, V. A. Samovol, M. B. Vasilyev, A. S. Vyshlov, L. N. Samoznaev, A. I. Sidorenko, and D. Ya. Shtern *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 41-46 refs (For availability see N76-25125 15-91)
CSCL 03B

Dual frequency radio sounding of the Martian nighttime ionosphere was carried out during the exits from behind the planet of the Mars-4 spacecraft on February 2, 1974 and the Mars-5 spacecraft on February 18, 1974. In these experiments, the spacecraft transmitter emitted two coherent monochromatic signals in decimeter and centimeter wavelength ranges. At the Earth receiving station, the reduced phase difference (or frequencies) of these signals was measured. The nighttime ionosphere of Mars measured in both cases had a peak electron density of approximately 5 X 1,000/cu cm at an altitude of 110 to 130 km. At the times of spacecraft exit, the solar zenith angles at the point of occultation were 127 deg and 106 deg, respectively. The height profiles of electron concentration were obtained assuming spherical symmetry of the Martian ionosphere. Author

N76-25129* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR-WIND CONTROL OF THE EXTENT OF PLANETARY IONOSPHERES
S. J. Bauer *In its* Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 47-62 refs (For availability see N76-25125 15-91)
CSCL 03B

In our solar system there are at least four magnetic planets: Earth, Jupiter, Mercury, and Mars; while at least one planet, Venus, appears to be essentially nonmagnetic. The ionospheres of the magnetic planets are imbedded in their magnetosphere and thus shielded from the solar wind, whereas the ionosphere of Venus, at least, interacts directly with the solar wind. However, the solar wind interaction with the planetary environment, in both cases, affects the behavior of their ionospheres. The role the solar wind interaction plays in limiting the extent of the ionospheres of both magnetic and nonmagnetic planets is discussed. Author

N76-25130* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERACTION OF THE SOLAR WIND WITH VENUS
H. S. Bridge (MIT, Cambridge), A. J. Lazarus (MIT, Cambridge), G. L. Siscoe (MIT, Cambridge), R. E. Hartle, K. W. Ogilvie, J. D. Scudder, and C. M. Yeates (JPL) *In its* Solar-Wind Interaction with the Planets, Mercury, Venus, and Mars 1976 p 63-80 refs (For availability see N76-25125 15-91)
CSCL 03B

Two topics related to the interaction of the solar wind with Venus are considered. First, a short review of the experimental evidence with particular attention to plasma measurements carried out on Mariner-5 and Mariner-10 is given. Secondly, the results of some recent theoretical work on the interaction of the solar wind with the ionosphere of Venus are summarized. Author

N76-25131* Academy of Sciences (USSR), Moscow. Inst. of Radio Engineering and Electronics.
SOME RESULTS OF CISLUNAR PLASMA RESEARCH **c90**
A. S. Vyshlov, N. A. Savich, M. B. Vasilyev, L. N. Samoznaev, A. I. Sidorenko, and D. Ya. Shtern *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 81-85 refs (For availability see N76-25125 15-91)
CSCL 03B

The main results of plasma cislunar investigations, carried out during Luna-19 and Luna-22 spacecraft flights by means of dual frequency dispersion interferrometry, are briefly outlined. It is shown that a thin layer of plasma, with a height of several tens of kilometers and a maximum concentration of the order 1,000 electrons/cu cm exists above the solar illuminated lunar surface. A physical model of the formation and existence of such a plasma in cislunar space is proposed, taking into account the influence of local magnetic areas on the moon. Author

N76-25132* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERACTION OF SOLAR WIND WITH MERCURY AND ITS MAGNETIC FIELD
N. F. Ness, K. W. Behannon, R. P. Lepping, and Y. C. Whang (Catholic Univ. of Am.) *In its* Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 87-99 refs (For availability see N76-25125 15-91)
CSCL 03B

A brief review is presented of magnetic field and solar wind electron observations by Mariner 10 spacecraft. The intrinsic magnetic field of the planet Mercury and the implications of such a field for the planetary interior are also discussed. Author

N76-25133* Academy of Sciences (USSR), Moscow. Space Research Inst.
EFFECT OF THE FROZEN-IN MAGNETIC FIELD ON THE FORMATION OF VENUS, PLASMA SHELL BOUNDARY: EXPERIMENTAL CONFIRMATION
Ju. V. Andrijanov and I. M. Podgorny *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 101-110 refs (For availability see N76-25125 15-91)
CSCL 03B

A laboratory simulation of solar wind interaction with plasma shells of nonmagnetic planets is reported. It is shown that the momentum transfer from the plasma flow to the shell occurs due to the presence of a frozen-in magnetic field. Without a magnetic field frozen-in, the ionosphere has no sharp boundary and a shock wave does not form in the flow. Author

N76-25134* Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
SOLAR-WIND INTERACTION WITH PLANETARY IONOSPHERES
P. A. Cloutier *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 111-119 refs (For availability see N76-25125 15-91)
(Grant NSF DES-74-19668)
CSCL 03B

Planetary encounters by numerous spacecraft have furnished information concerning the solar wind interaction with the planets Mercury, Venus, Mars, and Jupiter. While direct measurements have indicated a wide range of atmospheric densities and intrinsic magnetic field strengths, the data seem

to indicate that the flow pattern around nonmagnetized or weakly magnetized planets with atmospheres optically thick at ionizing wavelengths is basically the same as that around a strongly magnetized planet's magnetosphere, such as the earth's. The planetary ionosphere apparently presents a hard obstacle to the flow, with bow shock formation required in the supersonic, super-Alfvenic flow to slow and direct most of the solar wind plasma around the planetary ionosphere. Various aspects of the interaction are examined in the context of theoretical models in an attempt to explain observed details of the interaction regions of Venus and Mars. Author

N76-25135* Academy of Sciences (USSR), Moscow. Computing Center.
NUMERICAL STUDY OF SOME SOLAR-WIND INTERACTION MODELS WITH SPACE OBJECTS **c92**
O. M. Belotserkovskii and V. Ya. Mitnitskii *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 121-133 refs (For availability see N76-25125 15-91)
CSCL 03B

The considerable variety of atmospheric and magnetic field properties possessed by the planets results in a corresponding variety of flow details, and a remarkably rich field of comparative study of solar wind flow around major objects in the solar system. It is the purpose of this paper to present a review of the fluid aspects of these flows and how they are approximated to obtain tractable mathematical problems, and a commentary on possibilities for further improvements and on some misconceptions that have appeared in applications of the results. Author

N76-25136* Stanford Univ., Calif. Div. of Applied Mechanics.
MAGNETOHYDRODYNAMIC AND GASDYNAMIC ASPECTS OF SOLAR-WIND FLOW AROUND TERRESTRIAL PLANETS: A CRITICAL REVIEW **c92**
J. R. Spreiter *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 135-149 refs (For availability see N76-25125 15-91)
(Grant NCAR-745-415)
CSCL 03B

Problems in space physics are discussed whose models, in simplified form, reduce to a supersonic flow scheme with a detached shock wave, namely: (1) solar wind interaction with an intrinsic planetary magnetic field; (2) solar wind interaction with the ionized component of the atmosphere of a comet; and (3) solar wind interaction with the ionosphere of a planet which does not possess its own magnetic field. The numerical study of the above problems is performed with the use of magnetogasdynamic equations for an ideal single fluid model. From the physical veiwpoint, the problems are solved in terms of as simple phenomena as possible; the principal objective is to make recently developed methods of numerical analysis of mixed flows applicable to space physics problems. Author

N76-25137* Academy of Sciences (USSR), Moscow. Space Research Inst.
NUMERICAL SIMULATION OF THE EFFECTS OF MAGNETIC FIELD INDUCED BY PLASMA FLOW PAST NONMAGNETIC PLANETS **c90**
A. S. Lipatov *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 151-158 refs (For availability see N76-25125 15-91)
CSCL 03B

The interaction of a nonstationary plasma flow with a model ionosphere is studied. On the basis of a numerical simulation, the calculation yields results of the distribution of the plasma concentration and magnetic field in the transition region. Author

N76-25138* Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
PLANETARY MAGNETOSPHERES: A COMPARATIVE VIEW
A. J. Dessler *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 159-166 refs (For availability see N76-25125 15-91)
CSCL 03B

There are eight large bodies in the solar system about which definite statements regarding the existence or nonexistence of a magnetic field of internal origin can now be made. Of these bodies (Sun, Mercury, Venus, Earth, Mars, Jupiter, Saturn, and the Earth's Moon), only Venus and the Moon have negligible surface magnetic fields. By negligible is meant that the magnetic fields are so weak that they do not sensibly perturb the local solar wind. The other bodies provide an interesting zoo of magnetic field configurations and attendant charged particle behavior. Six of these bodies have magnetic fields, and two do not. Furthermore, of those which have magnetic fields, it appears that only that of Mars is ineffective in accelerating charged particles. Author

N76-25139* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE QUESTION OF THE ENERGY OF THE PRECESSIONAL DYNAMO **c90**
Sh. Sh. Dolginov (IZMIRAN, Akademgorodok, Moscow) *In its* Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 167-170 refs (For availability see N76-25125 15-91)
CSCL 03B

The various estimates for the coupling mechanism by which precession transfers rotational, kinetic energy of earth into the energy of its magnetic field are generally considering hydromagnetic stresses that originate between mantle and core. Estimates of the energy of the geomagnetic field calculated from the data of spherical harmonic analysis derive precession energy values in reasonable agreement with the observed external energy of the geomagnetic field and with the rate of ohmic dissipation of energy in the core. G.G.

N76-25140*# Stanford Univ., Calif. Dept. of Geophysics.
APOLLO 14 AND 16 ACTIVE SEISMIC EXPERIMENTS, AND APOLLO 17 LUNAR SEISMIC PROFILING Final Report
Apr. 1976 171 p refs
(Contract NAS9-5632)
(NASA-CR-147760) Avail: NTIS HC $6.75 CSCL 03B

Seismic refraction experiments were conducted on the moon by Apollo astronauts during missions 14, 16, and 17. Seismic velocities of 104, 108, 92, 114 and 100 m/sec were inferred for the lunar regolith at the Apollo 12, 14, 15, 16, and 17 landing sites, respectively. These data indicate that fragmentation and comminution caused by meteoroid impacts has produced a layer of remarkably uniform seismic properties moonwide. Brecciation and high porosity are the probable causes of the very low velocities observed in the lunar regolith. Apollo 17 seismic data revealed that the seismic velocity increases very rapidly with depth to 4.7 km/sec at a depth of 1.4 km. Such a large velocity change is suggestive of compositional and textural changes and is compatible with a model of fractured basaltic flows overlying anorthositic breccias. 'Thermal' moonquakes were also detected at the Apollo 17 site, becoming increasingly frequent after sunrise and reaching a maximum at sunset. The source of these quakes could possibly be landsliding. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-25141# New Hampshire Univ., Durham. Dept. of Physics.
EVALUATION OF A PREDICTION TECHNIQUE FOR LOW ENERGY SOLAR PARTICLE EVENTS Final Report, 2 Oct. 1972 - 30 Jun. 1975
Edmond C. Roelof and Robert E. Gold 15 Sep. 1975 52 p refs
(Contract F19628-73-C-0070; AF Proj. 8600)
(AD-A018739; AFCRL-TR-75-0503) Avail: NTIS CSCL 03/2

A technique has been developed for the prediction of low energy solar charged particle fluxes near 1 AU. It is based on comprehensive analysis of solar and interplanetary plasma, magnetic field and energetic particle observations. Although analyses have been carried out for periods in 1964-5, 1968-9, 1972 and 1974, a particularly detailed study has been done of

the period May-November, 1967 when there was extensive and near-continuous multi-spacecraft data coverage near Earth and in deep space. The prediction technique has been tested on this latter period and the results are satisfactory for the larger particle events. The results indicate that the inclusion of the effects of coronal magnetic structure on particle injection into the interplanetary medium are as essential as an accurate estimate of the time history of the accelerated particle flux. Quantitative models are used for coronal control (Access Probabilities) and particle acceleration (Flux Production Rules), the former based on the topology of low coronal magnetic neutral lines deduced from H alpha filtergrams, and the latter from solar flare optical and x-ray emission. It is concluded that the major needs for improvement in prediction techniques are more accurate indicators of particle production and active region magnetic field structure, as well as remote sensing of solar wind disturbances by daily monitoring of interplanetary radio scintillations. GRA

N76-25127* Academy of Sciences (USSR), Moscow. Space Research Inst.
ON THE NATURE OF THE SOLAR-WIND-MARS INTERACTION
O. L. Vaisberg, A. V. Bogdanov, V. N. Smirnov, and S. A. Romanov *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 21-40 refs (For availability see N76-25125 15-91)
CSCL 03B

N76-25135* Academy of Sciences (USSR), Moscow. Computing Center.
NUMERICAL STUDY OF SOME SOLAR-WIND INTERACTION MODELS WITH SPACE OBJECTS
O. M. Belotserkovskii and V. Ya. Mitnitskii *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 121-133 refs (For availability see N76-25125 15-91)
CSCL 03B

N76-25136* Stanford Univ., Calif. Div. of Applied Mechanics.
MAGNETOHYDRODYNAMIC AND GASDYNAMIC ASPECTS OF SOLAR-WIND FLOW AROUND TERRESTRIAL PLANETS: A CRITICAL REVIEW
J. R. Spreiter *In* NASA. Goddard Space Flight Center Solar-Wind Interaction with the Planets Mercury, Venus, and Mars 1976 p 135-149 refs (For availability see N76-25125 15-91)
(Grant NCAR-745-415)
CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-25142# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A NOTE OF RIOMETERS
N. DAngelo May 1976 17 p refs
(U-of-Iowa-76-15) Avail: NTIS HC $3.50

The view was put forward that certain cosmic radio noise 'absorption' events measured on riometers are probably due to radiation backscatter into space by E region irregularities (rather than to D region absorption). Experimental information in support of this view is discussed. Author

99 GENERAL

No abstracts in this category.